American Machinist

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Announcing the Winners of the American Machinist Awards for 1931

As the silent member of the Committee on Awards, I have been given the honor of announcing the winners of the 1931 *American Machinist* Awards for Most Effective Replacement Policies:

Class I. Norton Company
Class II. The Geometric Tool Company

To each is presented a bronze plaque, a purse of gold and a certificate signed by the members of the committee—in the words of the plaques which will be pictured in the forthcoming issue—"in recognition of the excellence of their policy for progressive equipment replacement." It will be remembered that Class I represents manufacturers in the machinery and metal-working industry whose average annual output is one million dollars or more; Class II represents manufacturers whose output is less. The smaller manufacturers were not compelled to compete against the larger.

On the following pages are reproduced the statements of the four distinguished active members of the Committee on Awards:

Dexter S. Kimball, Chairman
Dean of Engineering, Cornell University

Harold V. Coes,
Manager, Industrial Department, Ford, Bacon & Davis, Inc.

Dr. Julius Klein,
Assistant Secretary of Commerce

Fred W. Shibley,
Vice-President, Bankers Trust Company

Fortunately for my peace of mind, my vote was not needed to decide the winners.

The contest for the *American Machinist* Awards for 1931 was announced on page 778d of Volume 74. Manufacturers in the two classes were invited to submit briefs describing their equipment replacement policies in terms of results achieved, "to stimulate interchange of information on replacement policies; to lead the way toward realizing on the opportunities of the future for still further increasing the purchasing power of the dollar for manufactured products."

From the entries filed on September 1, 1931, the Committee selected the outstanding four in each class for final consideration and recommended that each be given publication in full. These, in alphabetical order are: Class I—Norton Company, SKF Industries, Inc., Warner & Swasey Company, Westinghouse Electric & Mfg. Company; Class II—Blanchard Machine Company, The Geometric Tool Company, Pittsburgh Gear Company, Rotor Air Tool Company.

The two winning briefs are published in this issue; the others will follow alphabetically, alternating by classes in six successive issues. Among them any manufacturer can find a successful, going equipment policy almost tailor-made to fit his own peculiar conditions. As such these briefs completely justify the philosophy underlying the contest.

After all, the Awards for 1931 are a logical and necessary complement to the larger program for modernization, and against obsolescence, initiated by *American Machinist* many years ago and carried forward without intermission.

On behalf of the *AM* staff I wish to thank each entrant and each member of the Committee on Awards for his sincere effort and enthusiastic cooperation.

K. H. Condit

Editor and Publishing Director

INFORMAL STATEMENTS

DEXTER S. KIMBALL
Dean of Engineering, Cornell University

ONE of the distinguishing characteristics of modern industrial management that differentiates it from "the good old days" is the marked tendency to formulate "policies" for all branches of business. Not many years ago, all policies were merely matters of judgment on the part of the general manager in consultation with his advisors, but most usually were not matters of record that would be helpful in the future. Labor relations, for instance, were entirely empirical and might change from day to day. Selling was a personal art in which the truth was not always a preeminent feature, and so on throughout the entire list of industrial functions.

So long as we were in a seller's market where, in general, the purchaser sought the manufacturer, and the demand often exceeded the supply, these somewhat crude methods sufficed. But the growth of mass production, the passing from a seller's to a buyer's market where the customer expects to find everything from wood screws to locomotives "on the shelf," the keen competition of modern days has greatly changed and quickened our ideas of how business and manufacturing should be conducted. Incidentally, the introduction of a large number of scientifically trained men into all walks of industrial life has also had much to do with modern notions of industry.

Many new ideas have been introduced into industrial management during the last forty years, but none of greater importance than the need of definite, stable policies in conducting every branch of the business. A policy, in the modern sense, is something more than a personal opinion. It is a carefully considered plan of action, having a given objective in view, and based upon the most accurate available knowledge of the field considered. Much progress has been made by many concerns in establishing policies from the location of the plant through all activities to the collection of sales returns, but again it is not unusual to see, or hear, of the most bungling sort of efforts occasioned by a lack of knowledge, or a disregard of pertinent and perfectly obvious facts.

The present appears to be an excellent time to consider equipment policies. If there is any feature of an industry that should be covered by a good policy it is the equipment itself. For the equipment is the capital investment and must be kept intact as to value, or its loss in value due to time and wear must be accumulated elsewhere if the industry is to survive. It would be interesting to know what proportion of the industrial plants in the United States have safe and sound equipment policies and how many still buy and scrap equipment empirically. An accurate equipment policy is an integral part of an accurate cost finding system, and no enterprise is safe that does not possess both. The competition sponsored by the *American Machinist* is, therefore, very timely and the replacement policies of the several companies that will be published should be a real contribution to the problem.

Dexter S. Kimball

HAROLD V. COES
Manager, Industrial Department, Ford, Bacon & Davis, Inc.

THERE is some merit in practically every one of the briefs which were reviewed and undoubtedly a symposium of all the ideas submitted would make a very interesting and valuable scheme of replacement. In other words, I hope that it will be possible to take the best out of each one of these briefs and prepare what might be termed an ideal or standard replacement plan based on accepted principles, policies and methods.

I liked particularly the scheme of placing responsibility for the use of modern equipment on everyone concerned, and in a most effective way, through its effect on the bonus of each individual. Careful attention must be paid, in any replacement policy, to the usage factor. In setting up the A.S.M.E. Material Handling Formula several years ago we took this factor into account.

It is unfortunate there was only one brief in the final eight covering the so-called quantity production, for the problems encountered in this type of manufacture, as we know, are of a different nature and decisions sometimes are much more difficult to arrive at.

It is interesting to note that practically all of the companies who submitted briefs had their awakening to the importance of this problem no further back than 1925. It is also interesting to note that in figuring depreciation they apparently subconsciously recognize the factor of obsolescence, and in their depreciation charges, varying from 7 to 15 per cent, make a very substantial allowance for obsolescence, I would say in the case of a 15 per cent depreciation charge they have practically allowed 5 per cent for deterioration and 10 per cent for obsolescence. In other words, obsolescence has retired more of the physical property than deterioration, which checks absolutely with my experience in many industries.

Harold V. Coes

by the Active Members of the

Committee on Awards

DR. JULIUS KLEIN
Asst. Secretary of Commerce

THE competition for the *American Machinist* awards together with many other experiences during recent months, emphasize the need of a definite equipment policy for American industry.

During 1929, and similarly during earlier boom periods, machinery was purchased not merely actively but in response to a demand that might almost be described as frantic. And then, following the collapse of the boom, not only in 1929 but in earlier instances, machinery buying collapsed to a point that might almost be described as paralysis. Obviously, it will be impossible to smooth out the oscillations of the business cycle unless we first smooth out these oscillations in the purchase of equipment, and it would seem that this can only be done in response to a definite equipment policy.

Such a policy would obviously involve a better understanding of the other factors involved in machinery purchase. There is reason to believe that, in this and other countries, factories house and operate an enormous quantity of obsolete machinery. The figures submitted by the various contestants demonstrate quite conclusively that American industry can reap handsome profits through the operation of a more carefully prepared replacement policy. Much profit is also to be derived from a better acounting practice as applied to equipment; a better correlation between engineering, accounting and management in getting the maximum profit out of modernized equipment as rapidly as it becomes available; the setting up of equipment reserves; and the taking of such other steps as may insure the adequate replacement of equipment when the progress of the art and other circumstances justify.

This contest has resulted in the collection of much valuable material which I trust will have the effect of demonstrating to the American business public the advantages to be secured from an adequate equipment policy properly tied in with an adequate accounting policy and an adequate management policy that will protect American industry from the risks that flow from obsolescence.

Julius Klein

FRED W. SHIBLEY
Vice-President, Bankers Trust Company

A PRIMARY factor in the accomplishment of low costs in factory operations is the coordinated flow of production as a whole. A replacement policy for machinery should always build itself around this idea. A machine shop, for example, should operate like a high-class watch. Every wheel, pinion, spring, screw and jewel must be sufficient for the task expected of it and must balance with every other part.

From an economic standpoint, the ultimate test of an adequate equipment replacement policy is profit. Buildings, machinery, the management and labor employed, are alike instruments utilized to produce profit on invested capital. The chief executive, the head of a division or department, every key man and every laboring man employed in a manufacturing enterprise, should come under the same instrument of measurement in relation to profit that necessarily must be brought to bear on plant and machinery. If this point of view is accepted in such an organization, there will be no question of adopting a sound replacement policy.

Human beings cannot be judged fairly by impressions and reactions, only by results. No rule-of-thumb policy or mathematical formula can be established for judging absolutely when an old machine should be scrapped and a new machine purchased, because there are so many relatives to be considered.

In any machinery equipment replacement policy which shall be adequate, the maintenance in cash, or its equivalent, of a proper depreciation reserve is an essential, for it is one thing to have a replacement policy and another to have the necessary finances.

Depreciation should be considered and treated as a direct cost. The life of a machine or a tool should be forecast when it is purchased and its cost amortized annually. The amount of this amortization should be deposited in a reserve that should be considered as sacred as a trust fund, and exactly comparable with a mortgage amortization fund deposited annually with a corporate trustee.

It will be claimed that it is not possible to forecast accurately the useful economic life of a machine. There is no more merit in this claim than in the assertion that sales cannot be forecast within reasonable bounds. Applied study will produce the dexterity necessary to secure in time a fairly accurate result. It is a fact that the great life insurance companies of this country have established a system of so forecasting the life expectancy of human beings that they are able to meet all death claims promptly and increase their reserves. They do not employ these reserves, however, in the payment of dividends or for any use other than death claims.

The time will surely come in the evolution of industry when it will be recognized generally that that business is most profitable which is operated within the bounds of reasonable rather than greedy expectations, and when reserves shall exist sufficient in amount to assure safety to capital and labor in a time of extreme depression like the present, that is, if so disastrous a condition could eventuate under such an intelligent system of business administration.

Fred W. Shibley

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Introduction

THE Norton Company, Worcester, Mass., is one of the largest manufacturers of grinding wheels and kindred products in the world. As an integral part of this organization, the Machine Division stands out in the machine-tool industry as one of the oldest and best known manufacturers of external grinding machinery. The following discussion applies only to Machine Division activities.

Nature of Product

Products of the Machine Division are plain cylindrical grinding machines, semi-automatic and full automatic grinding machines, surface grinding machines, crank-pin and camshaft grinding machines, car-wheel grinding machines, universal tool and cutter grinding machines, multi-purpose grinding machines, running balance indicating machines, and a complete line of lapping machines for flat and cylindrical work, including crank-pin and cam lapping machines. These machines are made in a variety of types and sizes ranging from the small universal toolroom grinding machine to the large 36x288-in. cylindrical grinding machine weighing 43 tons—in all about 300 different types and sizes of machines. Many of these machines are made only on order, so that only the smaller sizes can be made for stock and in lots of a size even as high as five or ten. These 300 different machines are made from something over 50,000 different parts.

It can, therefore, be readily seen that mass-production methods are out of the question and that the field for special machinery is extremely limited. Good general-purpose machines must be employed, and the set-up time for the different parts plays a very vital part in the whole picture.

Layout of Shop

The factory is laid out in six mills; with the exception of one mill, they consist of a main floor with a second-floor gallery on three sides of it. The sixth

A Replacement Policy that Shares Responsibility

ROY C. BLANCHARD
Methods Engineer, Norton Company, Machine Division

How Norton Company, Machine Division, by adopting this common-sense policy, increased production capacity 15 per cent, reduced production floor space 20 per cent, improved quality and cut the average age of its equipment to 8.9 years. Prize-winning brief for the *American Machinist* Award for 1931, Class I, companies in the metal-working industries whose average annual output is one million dollars or more

mill contains five floors, the three upper floors of which are used for the storage of parts and the experimental department. The producing section of the factory, therefore, is concentrated on two floors, and the mills are located side by side and connected by passageways at either end to facilitate trucking from one mill to another.

The factory is laid out in departments by machine processes and not by lines of product; that is, all drilling is done in one department, etc. Now that our rearrangement program has been completed, the different departments are so located that all material starts at mill 1 and passes successively from one mill to another until it is completed and ready for stores in mill 6, or ready for assembly or erecting in mill 4 and shipping in mill 5. The general scheme of layout of departments is to have the first operation departments in mills 1 and 2 and the later operation departments in mills 2 and 3.

A further innovation is to have heavier machines such as planers, boring mills and grinding machines on the ground floor, and the lighter machines, such as lathes and milling machines, in the galleries. In this way the lighter work predominates on the galleries and the heavy parts travel on the ground floor. Machines on the ground floor are still further arranged so that the heaviest machines are located toward the south end of the mills where an industrial track is located which runs from mills 1 to 5. This reduces the heavy crane work to a minimum, and takes all heavy, dangerous trucking away from the north end of the mills where the offices are located, and where most of the pedestrians pass from mill to mill.

In this way the entire plant is laid out to approach a state of progressive manufacture as nearly as the manufacture of grinding machines will permit. Such a layout not only minimizes trucking and the back-tracking of parts in process, but aids planning and scheduling of parts, reduces confusion and is a material aid to the difficult task of meeting shipping dates.

Too much cannot be said in favor of the sensible arrangement of equipment in any factory. One does not realize the intangible as well as tangible savings resulting from such an arrangement unless one has seen the same plant work under both the haphazard and the sensible arrangement of departments and equipment.

Inventory of Productive Equipment

The Norton Company has made a creditable effort in putting its house in order during the last few years. The present equipment is thoroughly up to date, in every way consistent with a machine-tool building concern, and

EXHIBIT A

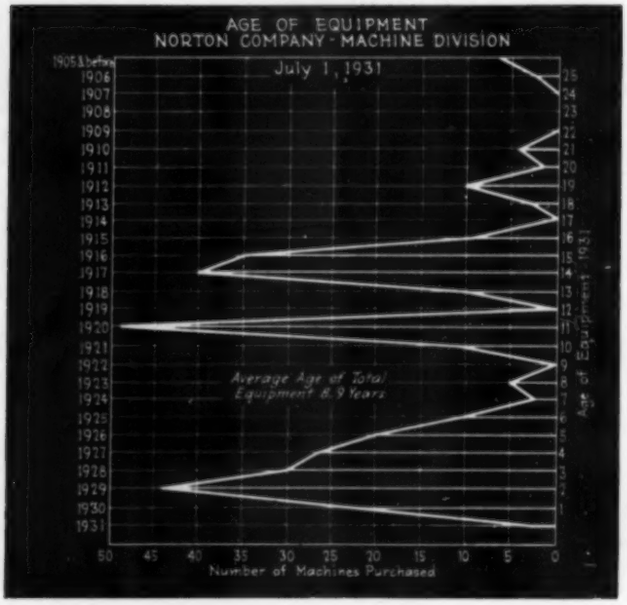
EQUIPMENT PURCHASED
NORTON COMPANY
GRINDING MACHINE DIVISION
July 1, 1931

Department Number

Year of Purchase	2	3	4	5	6	7	8	10	12	14	15	17	18	19	21	25	28	29	30	38	40	Total	Age in 1931
1905 or before			1	1			1	3														6	
1906							1	1														2	25
1907																							24
1908																							23
1909																							22
1910			1	2													1					4	21
1911			1																			1	20
1912				1			2	2									3	1	1			10	19
1913					1			1					1						1			3	18
1914																							17
1915					1		3	1			1								1	2		9	16
1916	5	1	2	1			6	5	2	1		1	2	1		1		2	4	1		35	15
1917	1	2	3	2	1	1	7	3	7	1		1	1		1	2	1	2	1	2		40	14
1918					1		1	1	1								2	3		4		11	13
1919																							12
1920	3	9	4	2			3	3	1	6	2		1		1	3				9	1	48	11
1921							6		5													11	10
1922																							9
1923								1		1	1				2							5	8
1924																			1			1	7
1925			1		2							2	2		2	1						10	6
1926			2	1		2	2			1	1				5	1	3		2			20	5
1927			1	1	1	1	2	1	4	2	1			1	2		1	1	3	4		27	4
1928			1	3	2	1	2	2			1	2		7		2		7				30	3
1929	1	1	1			5	6			5		8		13	1		3	1				44	2
1930	4	2	2		1	3	1						5		3		2	1				24	1
1931												3										3	

Average Age 8.9 Years

EXHIBIT B



no effort is spared to keep it so. Over 100 major pieces of machine equipment were purchased since the inauguration of the replacement program—a procedure that takes courage as well as conviction on the part of any management.

Exhibit *A* gives a tabular resumé of the entire equipment and the same figures are also represented graphically in Exhibit *B*. This curve shows number of machines and not expenditures in dollars, as the latter figures would be of little use as a comparison over the period shown in this chart, due to the great change in prices.

It is a fact that most of the oldest machines are part-time equipment, which may be old in years but not in point of service. However, the average age of all machines, both full-time and part-time equipment included, is but 8.9 years, a record of which the Norton Company is justly proud.

Accounting Practices Regarding Replacement

The Norton Company follows a very simple and conservative accounting policy regarding replacement of machinery. A straight-line policy on depreciation of 10 per cent per year is used. Replacement expenditures are taken from the surplus, and this surplus is controlled so that when improvements or replacements are needed, the necessary funds are available. The equivalent, therefore, of a replacement reserve is maintained, although it is not controlled separately or known as such.

Wage Payment Plans & Control

The methods of payment both for direct and indirect labor lend a very distinct color to the background of the picture of "Machine Replacement" in any shop. A good wage payment plan not only obtains the maximum feeds and speeds consistent with safety and good practice, but also secures the cooperation of indirect labor as well as direct labor in attaining highest efficiency at lowest cost.

EXHIBIT C

WEEKLY INCENTIVE REPORT

Dept. No. 29 Boring mill — Week Ending 10/11/30

Clock Number 1	Direct Labor Hours Allowed 2	Actual 3	Incentive 4	Day Work 5	O.T. Hours 6	Extr. 7
Operators Paid on Incentive Wage Payment Plan						
14081	51.7	36.0	15.7			90
14085	82.6	48.0	34.6			108
14086	46.8	36.0	10.8			81
14098	3.7	0.4	3.3			95
14099	58.6	33.9	24.7		3.0	108
14093	85.5	25.0	40.5			164
14046	33.2	21.1	11.1			95
14098	Jouman	11.6	mr. D.	33		
13932	Tool crib					
13934	" "					
TOTALS	347.1	206.4	140.7		3.0	105

EXTRA EARNINGS

Direct Labor 34.1%

Example:

Direct Labor
Col. C 70.4 / Column B 206.4 = 34.1%
Paid Incentive Jobs Only

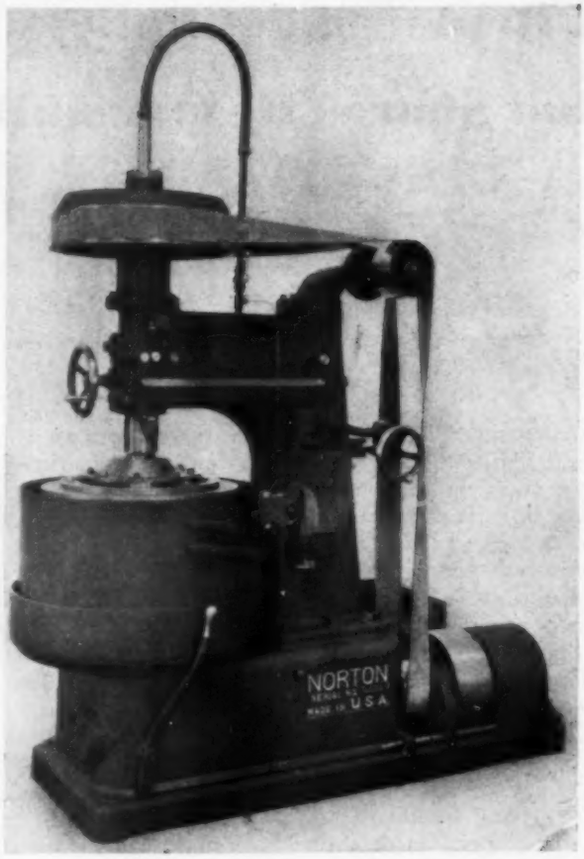
Remarks:

Indirect Labor Actual Hours
26.4
22.5
25.0

G: 73.9

Compiled by W. G. — Approved W Graham

Average to date 90%



Lapping machines constitute an important part of Norton production

Direct Labor Incentive

The form of incentive for direct labor is called the 50-50 plan. That is, the savings made by direct labor from the allowed times on the different jobs are split 50-50, one-half going to the operators and the other half to the company. A portion of the company's half goes into a fund from which the indirect labor is paid a bonus. In this way the foremen, utility men, clerks, tool crib operators, etc., have an incentive to help the direct workers in every way so that their efficiency will be as high as possible, for the higher the incentive earnings for direct labor, the higher becomes the added earnings for the above-named indirect labor.

This whole plan is effectively controlled so that the working force can be kept in line with production at all times. This is easy to do when passing into periods of good business from a depression, but is not so simple when going down into a depression. Working forces, as a rule, are not reduced quickly enough in the latter cases. The control at the Norton Company, however, has been such that the correct actions to be taken have made themselves apparent so quickly and unmistakably that throughout the present depression the foremen and tool crib operators have continued to earn a bonus. Such a fact is especially noteworthy when it is realized that such departments as snagging, cutting-off, packing and shipping, painting, heat-treating and tool making are on this incentive system as well as the regular production.

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Indirect Labor Incentive

Clerical departments such as Planning, Rate Setting and Engineering have controls set up allowing varying amounts of clerical labor for varying shop productive hours, so that even these departments must keep in line with the general shop conditions. There are similar controls set up throughout the office and factory departments for every kind of controllable item, such as stationery, repairs, supplies, supervision and spoilage.

The success or failure in meeting the established allowances for these controllable item affects a bonus fund which is used to pay foremen and other key men throughout the organization up to the works manager, a bonus for savings made. Such a combined incentive system for both direct and indirect workers simply places every man in business for himself, and keeps him eternally on the alert for the little things that usually slip by unnoticed.

Methods Employed

The need for expansion is often the reason for the purchase of new equipment. In such cases care and thought must of course be exercised in order to purchase the right equipment; but there is not present that everlasting watchfulness, that painstaking study, necessary to decide and prove the necessity of replacing present equipment with new. Expansion suddenly thrusts the necessity upon one so plainly that even a blind man could see it, but the need for replacement does not

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shout at one until breakdown causes loss of money and temper. If this occurs, replacement has waited too long. Such breakdowns usually occur at the peak of production when they can least be afforded. A little watchfulness and careful analysis applied systematically and efficiently at all times will prevent such catastrophes.

Empirical Formulas Are of Little Use

To the executive who thinks he is too busy to study details and take the pulse of his equipment occasionally, the first thought that occurs to him is this: "Is there some cure-all formula that can be employed that will tell me just when to make replacements?" And the answer is: "Just as there is no one medicine that will always cure all the ills to which human bodies are heir, so there is no one formula that will show unfailingly when the equipment in a machine shop is approaching a state of ill health. There may be a formula for each kind of machine tool that will do this, but it is much safer to take the pulse of shop equipment occasionally, and then to do something about it. There are unmistakable signs to watch for, but the problem is how, when and where to take that pulse."

Poor Service Rendered Is Greatest Cause for Replacement

We begin to think about buying a new automobile when the old one fails to give us the service we expect from it. We should do the same thing with our machine tools, and we would if we were running them ourselves. But, unfortunately, the men who operate our machines are not the ones who furnish the money to buy new machines, and unless there is some way to make these faults apparent and stand out plainly, no one is the wiser until it is too late.

The workman's first thought, quite naturally, is his pay envelope, and little else except inspection regulations occupies his mind. He manages his own little job; the broader phases of good management he leaves to somebody else.

The foreman, with his larger responsibility, usually thinks he is so busy with his myriad duties in keeping up production that he does not shoulder the responsibility of seeing that his machines give the service they should, unless that service affects his production. Unconsciously he passes this responsibility along up the line; consequently no one takes it upon himself. Laxity of this sort does not affect the foreman's wages, so why should he worry? If, however, that laxity could be made to touch the foreman's pay envelope, then there would be aroused in him such qualities of management as he never realized he possessed.

There is another point that means more to some individuals than the mere addition of a bonus for good management. In order that the bonus can be paid, a means of control for measuring the success of the different functions must be set up. This ability to measure one's job provides a proof and a recognition of work well done to which anyone can point with pride.

This is the keynote of the whole plan employed by the Machine Division of the Norton Company: "Passing the problems of management 'down the line' makes it possible for the successful handling of these problems to influence the respective wages of all concerned, from the superintendent down to the workman at the machine."

Watch for Distress Signals

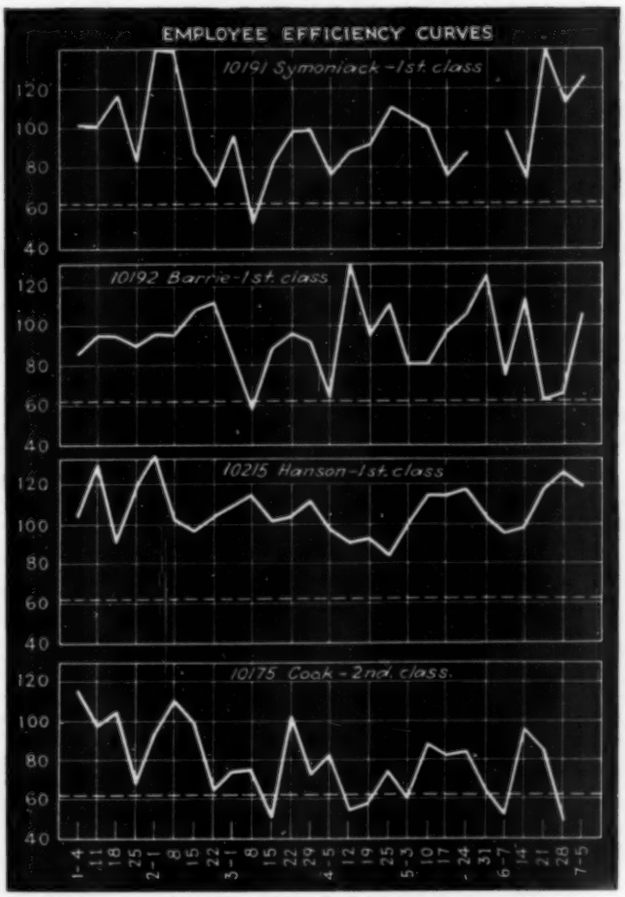
One of three things usually takes place when a machine begins to show signs of failure. The operator's efficiency begins to fall, extra allowances on piece rates increase, or the cost of repairs goes up. A close check on these three items will invariably uncover difficulties in the operation of a machine. This is the time to make a careful analysis.

At the Norton Company the weekly efficiencies of the operators are shown in the form of a report to the foremen, superintendent and methods department, Exhibit *C*. Curves are kept of each man's efficiency, Exhibit *D*, so that trends can be studied. All extra allowances on piece rates given for any reason whatever are recorded and segregated to the different possible reasons, so that a complete study of this phase of the subject can be made at any time. And lastly, machine repairs are recorded by machine; hence a complete analysis of this item is ready at all times. All three of these items not only should be watched but will be watched when the several pay envelopes are affected.

Control of Repairs

Allowances are set up for all items in each department which can in any way be controlled by the foreman. Exhibit *E* shows the "Machine Repairs" item for one particular department. This curve gives a goal for the foreman to shoot at for the complete range of possible productive capacities. Production figures are given to the foreman each week by weekly efficiency report, so that he can calculate from the curve just what he is

EXHIBIT D



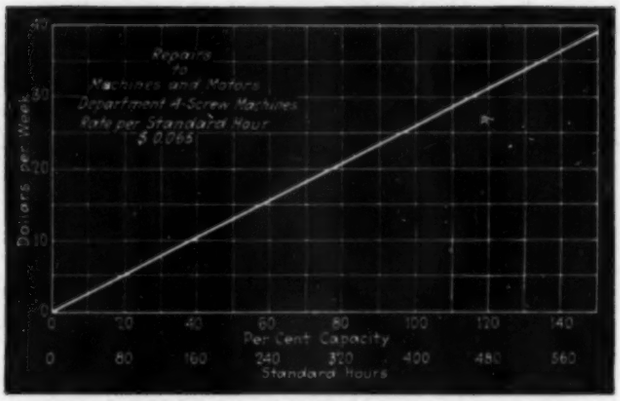

Repairs to Machines and Motors Department 4 Screw Machines Rate per Standard Hour $ 0.065
Dollars per Week
Per Cent Capacity
Standard Hours

EXHIBIT E

allowed for machine repairs. It focuses his attention on the item because, if he can beat the allowed figure, a saving goes into a fund which is used to pay him a bonus every month. If he discovers that his machine repairs are costing him more than they should, he will start an investigation of his troubles at once, or get somebody else to do it for him. That somebody else, irrespective of whom it may be, will be more than glad to help him. He too is interested, since that same item also affects the general bonus fund, which has a bearing on his bonus.

When a foreman believes it will be economical to give a machine a general overhauling, he asks for an appropriation for this purpose, specifying how much he expects to save in repairs and over what period he expects to save the cost of the overhauling in decreased repairs. This overhauling, if sanctioned, is charged against the foreman's budget in monthly installments based on his estimate.

Naturally, when the overhaul is recommended, consideration is given to the advisability of purchasing new equipment. If new equipment is purchased, charges are made against the department for the added depreciation and interest on the new equipment. Thus a foreman is always required to weigh five things in his mind:

1. His current repairs
2. The savings in repairs possible by general overhauling
3. The savings in repairs possible by purchase of new machine
4. The increased cost of depreciation and interest on new equipment
5. The possible labor savings to be made by purchase of new equipment.

The question might be asked whether it would be possible for a foreman to neglect repairs, let the machines run down badly and thereby increase his bonus. Then, when he reached a time where it was absolutely necessary to purchase new equipment, he might resign. The Company would then be left with a higher cost due to increased depreciation and interest, and the foreman would have gotten an unearned bonus. If this should happen the Company would not have to bear the whole burden, for general foremen, the superintendent, the equipment engineer, the methods engineer and others would have to stand the penalty of the increased cost in that department, because these increased costs would cut into their bonuses. This provides a very definite check.

Thus the network of interest and responsibility is woven into the complete fabric of good management that

OPERATION CODE NUMBERS

	Code		Code
Polisher	.01	Auto. Lathe	.40
Planer	.02	Chucking Lathe	.41
Auto. Screw	.03	Engine Lathe	.42
Hand Screw (Bar Work)	.04	Pulley Lathe	.43
Shaper	.05	Speed Lathe	.44
Weld	.06	Turret Lathe	.45
Hand Scr. Mch. (Chuck Wk)	.07	Int. Thread Mill	.46
Vert. Shaper P&W	.08	Planer Mill 72"	.47
Jig-Borer P&W	.09		.48
		Tool Room	.49
Bench	.10		
Assemble	.11	Horizontal Drill	.50
Erect	.12	Sensitive Drill	.51
Scrape (Floor)	.13	Upright Drill	.52
Scrape (Bench)	.14	Radial Drill	.53
Babbitt	.15	Planning Dept	.54
Running Balance	.16		.55
Standing Balance	.17	Nibbler	.56
Press	.18	Wiring	.57
Assemble-Whl.Gis.All Oper.	.19	Layout	.58
		Make Complete (D-14)	.59
Surface Grinder	.20		
Cam Making	.21	Centering	.60
Crankpin Grinder	.22	Chipping	.61
Disc Grinder	.23	Broaching	.62
Floor Grinder	.24	Make Complete	.63
Internal Grinder	.25	Lapping	.64
Plain Grinder	.26	Cut Off	.65
Bench Grinder	.27	Gear Cutter	.66
Tool Grinder	.28	Painter	.67
Universal Grinder	.29	Smithy	.68
		Flame Cutting	.69
Duplex Mill	.30	Semi-Auto.Grdr.	.70
Horizontal Mill	.31	Plunge cut .20 pc.or over	
Keyseat Mill	.32		
Keyslot Mill	.33		
Screw Slot Mill	.34		
Thread Mill	.35	NORTON COMPANY	
Vertical Mill	.36	Grinding Machine Division	
Hor. Boring Mill	.37	Piece Work & Routing Dept.	
Vert. Boring Mill	.38		
Planer Mill 42"	.39		

EXHIBIT F

insures a constant control of the item of repairs, or any other controllable item for that matter, from month to month.

Improvements in Quality Or Productive Capacity

There is another important phase of the subject of machine replacement which, ordinarily, is out of the province of the foreman and more in the province of the Methods Department or equipment engineer. Even though the present machines may be giving good service in every way, still there may be new equipment on the market that will greatly increase the present production or quality. It is our practice to keep in constant touch with such improvements. Not only is it possible to obtain estimates of production from the machine makers on samples of our own work, but the data from which our own rates are set up is so complete and in such elemental detail that it is possible to figure our own savings on our own parts from the information obtained from the machine makers. The different machining operations have different code numbers Exhibit *F*, and every rate that is figured is given the proper code number. It is therefore possible to study any number of rates for any particular code number quickly, select the jobs that might be affected by any betterment, and calculate the possible savings to be made. The Planning Department keeps complete records of the usage of every part for at least three years back, so there need be no guess work about the whole proceeding.

Exhibits *G* and *H*, used as a reference book sheet (page 741), illustrate samples of both set-up and cutting time tables from which the rates are set. Exhibit *I* shows a sample of an actual rate set from those or similar time tables, and Exhibit *J* displays a partial list of parts actually investigated to show savings to be made by the installation of one of our own semi-automatic grinding machines as against our own plain cylindrical grinding machines. The former employs the plunge-cut principle rather than the traverse principle, so that certain parts were found to be particularly suited to this kind of grinding. The list of parts given is but a small part of the complete investigation as it was made, and is shown simply to give an idea of the form taken by such an investigation.

Obsolescence

Replacement of machine tools in a machine-tool manufacturing plant as a result of obsolescense is not as far

EXHIBIT I

Machine PLAIN GRINDER | Size | Material T.S. | Dept. 7 | Oper. 5 | Part No. 23307
Part Name | Code 126

Tools & Equipment — JOB RATE SHEET

TAPER SLEEVE GAGE PT. 23102
TAPER SLEEVE GAGE #6 JARNO
7-11126

CHANGES: DATE | BY

Per Job: 30.00 x 1.6 x 1.9 = .80

Time Per Piece — Per Piece: 10.15 x 1.6 x 1.9 = .27

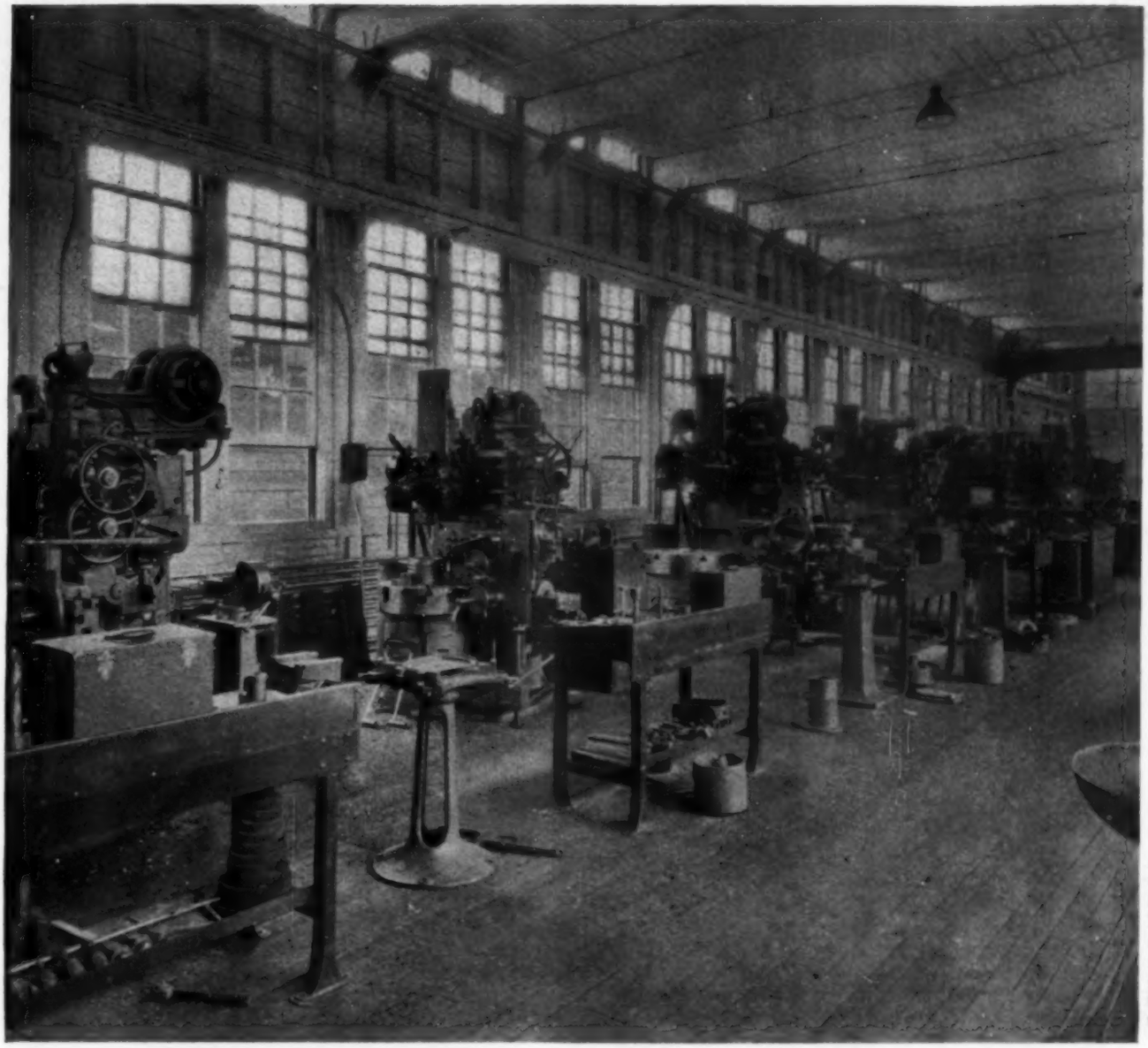
Set Up Elements

JOB ALLOWANCE	7.00
STRAIGHT (2)	5.00
TAPER (2)	18.00
Total	30.00

Operations	R.P.M.	Stroke	Feed	Depth of Cut	Diameter of Tool	No. of Cuts	Time Unit	Factor	Time Per Piece (Hrs.) Machine Time	Floor & Bench	Remarks	Total Adjust.	Total
GRIND 7/8"					1"	(2)	.28		.28	.50		.50	
" 3/4"							.28		.28	.50		.50	
" #6 JARNO					3"		.28		.84	.75	60	.75	
" 3" PER FT.					2"		.43		.86	.75	.60	.75	
									2.26	2.50	1.20	7.50	8.96
									20% ALLOWANCE				1.69
													10.15

Figured Date	Figured By	O.K. By	Part Index Checked	Rate Sheet Changed
2-31-30	HMH	CEH	CEH	CEH

Total | Total



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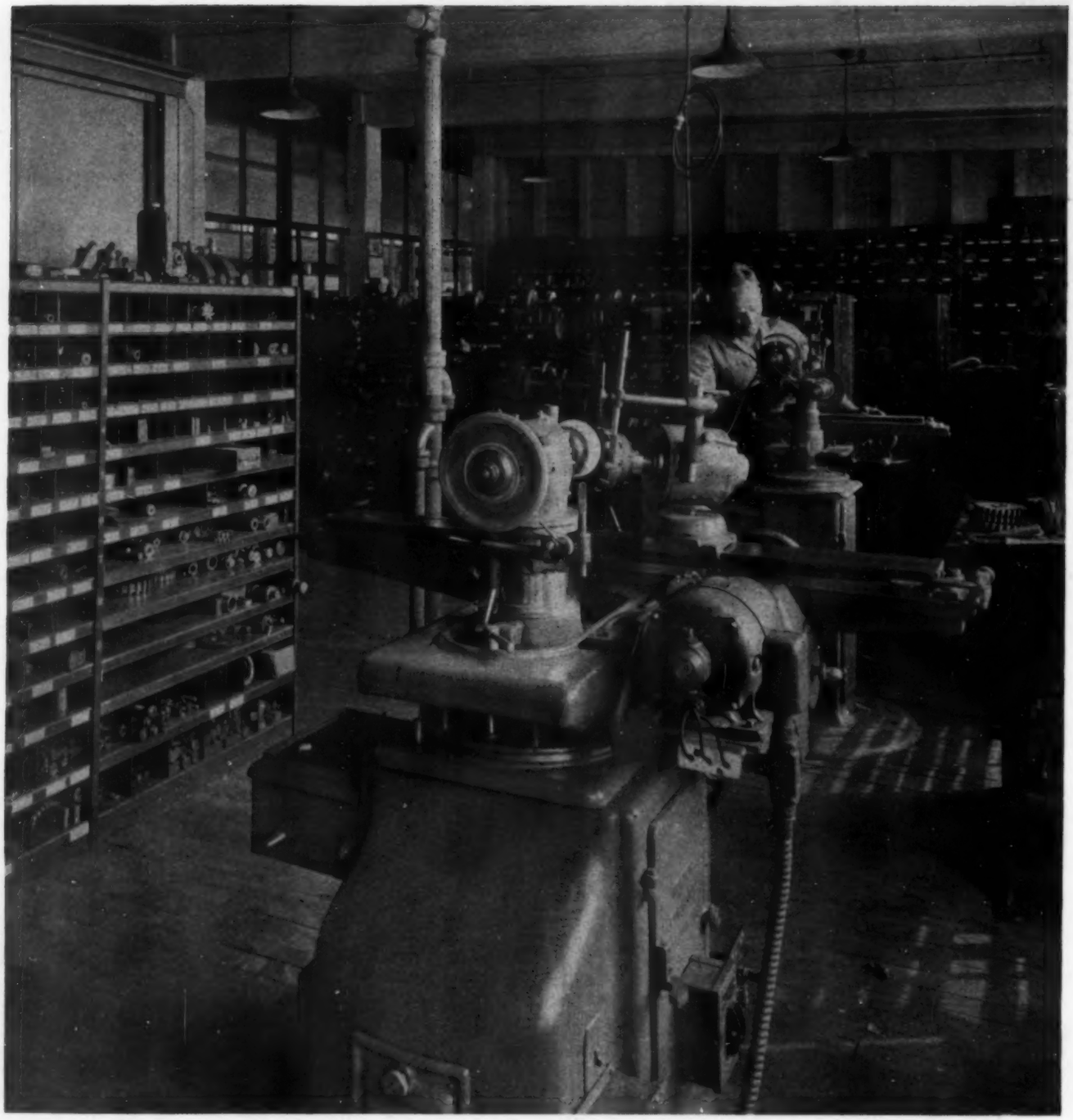
reaching in its effects as in many other types of manufacturing plants. Machine tools in practically all phases of machining operations have of late years become more and more highly specialized, so that instead of manufacturing modern machine tools in large lots and storing them away, selling them out as so many units, the special adaptation of the tools to the particular job necessitates more or less of a tailor-made type of business.

The machine equipment employed, therefore, in the manufacture of such a character of product is not as quickly made obsolete as it would be in a business where mass production and large quantities of parts in one order make possible the scientific study of the lowest cost possible in any particular operation.

It will be observed, therefore, that machine tools for this as well as other machine-tool manufacturing plants must be of the general utility type and more or less universal in their characteristics, so that obsolescence as a result of improvement in design is less marked. It will also follow that the normal life of a machine tool n a machine tool plant is greater than in the plant employing mass production. Whether the dead line for age be placed at 10, 12, or 15 years is of little consequence. What really matters is whether the present equipment is giving good service, or whether there is new equipment on the market that will do enough more or better work to make it profitable to purchase new equipment and dispose of the old. No set rule can be established. Common sense must rule at all times, and a careful study of all the facts will indicate the right step to take.

Cost of New Equipment

The cost of new equipment, of course, is an important consideration, but there is more to be considered than the bare cost of contemplated new machines. What of freight and installation charges, special equipment charges, the probable second-hand value of the machine when sold or traded in, cost of additional tools and fixtures, depreciation, cost of floor space, cost of power, probable cost of repairs and interest on investment? All of these items must be given consideration. Balanced against these items are the tangible savings in direct labor, material, expense, repairs, power, main-



Tools never leave the department for which they are made. A corner of one of nine completely equipped tool cribs

tenance, etc., and intangible savings such as greater accuracy, better product, better appearance of factory (motor drive as against belt drive) and company pride or reputation for keeping equipment up-to-date.

No two cases are alike; each must be considered on its own merits, with the proper weight placed on the different items and the whole picture tempered by necessarily ever-changing company policies.

Choice of Machine Supplier

In making a choice of new machines other points must be considered besides cost. Many times these points are important enough to warrant an added expenditure with the confidence of having done the right thing. The reputation of the supplier for building good machines and standing back of them is a point of no small importance and must receive consideration whenever the choice of a machine is to be made. A good reputation must be built up by continually building a good product that gives satisfaction, an earnest effort to give good service, and a desire to keep customers satisfied after the purchase price is paid. It is one of those intangible qualities that may take years to build up, can be lost by a gesture, and yet, when possessed, is a very vital factor in the success of a business. And that very success which means operating at a profit is an insurance that the machine supplier will continue in business. This point should be borne in mind by the purchaser when the thought of new equipment is contemplated.

Selection of Proper Machines

When all of the above points have been thoroughly investigated, and not until then, comes the time for the decision as to the selection of the proper machines to purchase. The many different angles of the whole question must be weighed and the facts established. When the facts are all available, the correct decision is easy to make. It is when the trouble to obtain the facts is not taken that the decisions are difficult to make.

To insure these facts being obtained and considered properly, the request for the purchase of all new equipment at the Machine Division of the Norton Company comes from the manufacturing equipment committee, which has the following members: equipment engineer (chairman), superintendent, chief engineer, methods engineer, general foreman and foreman of department concerned.

This committee has no regular time for meeting and gets together only when called by the chairman. Each member has his particular phase of the subject to watch and report on. What is still more important, every member is as interested in the facts obtained by the other members as he is in the ones for which he himself is responsible, for the wages of all will be affected by the decision through the indirect labor bonus. When a recommendation to buy a certain machine or group of machines comes from such a committee, the management can be certain that the whole question has been thoroughly investigated, and that the decision would be the same if the committee itself owned the business.

A sample of the kind of information presented for the manufacturing equipment committee's consideration is shown in Exhibit *K*. The figures used are fictitious, but they show what kind of tangible information is considered along with the intangible considerations that go with every such decision.

Machines *B*, *C* and *D* were rival machines of the same size as machines *E*, *F* and *G*, which had been entirely depreciated and were showing a marked increase in repairs. The labor value of all the new machines was appreciably more than that of the old machines, but the labor value of machine *B* was the best of the three new ones. Although the yearly cost of machine *B* was about $300 more than that of *C* and *D*, still the increased labor value and the fact that the concern in back of machine *B* had much the best reputation of the three led the committee to recommend the purchase of one of the *B* machines.

Machine *A* was much more expensive, but employed an entirely new process. This accounted for the large initial cost of tools and fixtures. Notwithstanding the increased yearly outlay for extra tools and larger initial cost, the large increase in labor value over even machine *B*, and the fact that machine *A* represented the latest word in equipment of this sort and was made by a first-class concern, led the committee to recommend its purchase. One machine *A* and one machine *B* were bought to replace the three old machines, with a resultant increase in labor value and a saving in floor space and repairs.

A great many more comparisons might be drawn from such figures, but it is only intended here to illustrate the kind of information that is put together for the consideration of the manufacturing equipment committee.

Results Achieved

One example of replacement and the resulting savings is that in which four semi-automatic turret lathes replaced eleven old machines. This installation was taken in two steps. Two machines were bought first. They proved their worth so well that two more were purchased, giving a total of four machines which now do the work for which eleven old-style machines were used. A great number of parts were studied; they showed a saving of anywhere from 15 to 50 per cent of the old cost. In addition to the labor saving, there was a saving in floor space and power plus a much improved and more accurate product.

Another example is that in which four flat turret lathes replaced six old machines. This installation was also made in two steps. Two new machines first replaced two old machines. Then the following conditions were found to be present, as quoted from the report of the chairman of the manufacturing equipment committee to the works manager: "The machines . . . are very inefficient in that they are in poor condition and require considerable attention from the repair men. They are inaccurate and require all sorts of tricks to bring the work out in a condition which will pass the inspectors.

"These machines, because of their condition, are oper-

INVESTIGATION OF SAVINGS – NORTON COMPANY – GRINDING MACHINE DIVISION

Part Number	Usage 1928	Usage 1929	Usage 1930	Average Usage per Year	Allowed Hours per Piece Plain Grinder	Allowed Hours per Piece Semi-Automatic	Total Allowed Hours per Year Plain Grinder	Total Allowed Hours per Year Semi-Automatic	Allowed Hours Saved Semi-Automatic Over Plain Grinder
S-374	202	293	151	215	0.085	0.05	18.28	10.75	7.53
S-2,094	80	103	42	75	0.14	0.03	10.50	2.25	8.25
S-2,095	396	531	106	278	0.24	0.05	66.72	13.90	52.82
1,465	805	935	365	702	0.05	0.015	35.10	10.53	24.57
1,466	460	405	149	345	0.04	0.015	13.80	5.18	8.62
2,401	55	83	39	59	0.22	0.05	12.98	2.95	10.03
2,402	247	360	161	256	0.03	0.015	7.68	3.84	3.84
3,514	92	191	68	117	0.10	0.03	11.70	3.51	8.19
3,605	100	159	65	108	0.18	0.05	19.44	5.40	14.04
3,634	120	194	84	133	0.14	0.05	18.62	6.65	11.97
3,642	169	299	245	238	0.27	0.06	64.26	14.28	49.98
3,658	237	259	22	173	0.14	0.03	24.22	5.19	19.03
3,702	184	169	77	143	0.21	0.03	30.03	4.29	25.74
4,281	193	169	53	138	0.13	0.03	17.94	4.14	13.80
6,556	129	203	146	159	0.12	0.05	19.08	7.95	11.13
12,606	192	176	25	165	0.08	0.015	13.20	2.48	10.72
13,558	272	318	133	241	0.055	0.003	13.26	7.23	6.03

EXHIBIT J

Certain parts were listed and investigated for possible savings. The question was whether a plain grinder should be replaced by a semi-automatic unit. It was

Heavy jigs and fixtures are stored in separate bins in the department toolcribs. A tiering truck facilitates handling

ated by two operators who shift about to get the best results possible. Therefore the production has been cut down and the product is not of the high quality we desire."

Extra allowance had increased as well as repairs and the new machines were showing increases of 20 per cent or better in production. Therefore, the wise thing to do was to purchase two more up-to-date machines.

A New Gear Shaper Saves 66 2/3 per cent

Old gear-shaping equipment was slow and occasionally turned out inaccurate work. To overhaul would cost about $1,500 per machine. A new machine would do the work in one-third, and in some cases one-fifth, of the former time. There was more work than could be handled with the old equipment; hence the new machine not only rectified this serious production trouble but also did more accurate work and made savings that would pay for the new machine in about three years.

Two Lathes Replace Four Old Machines

This was a case of from one to two men operating four lathes on a special job which was very vital to the manufacture of grinding machines. By the installation of the two new lathes, higher speeds and feeds could be used. Thus one operator could obtain the same production with the two lathes that was formerly obtained with two men on the four machines, besides producing a better job. There was also a saving in power, floor space and repairs.

Another case is on record where two new horizontal shapers replaced three old machines. The three old machines could still do good work but some of the more accurate jobs were beginning to give trouble. The new machines were modern in every way and fully equipped with all the time-saving devices available. One operator was eliminated, giving a saving of around $1,500 a year, and in addition to this it was possible to obtain more accurate work with less effort. An addi-

tional incentive for purchasing at that particular time was a proposed increase in price of 10 per cent which was contemplated by the supplier.

Installation of Vertical Shaper

It was found that the installation of a vertical shaper would effect a saving of about 15 per cent in a considerable number of operations handled previously by planing, milling or horizontal shaping. The tools required would be much sturdier with less likelihood of breakage, and the accuracy was very dependable. It would also bring the shop more up-to-date by employing a process not available before. This installation has proved to be a satisfactory one in many ways.

Planer Mill Replaces Planers

Some of our planers were needing replacement due to the increase in repairs and lack of accuracy. In addition to purchasing new planers which would do more and better work, it was decided to install a planer mill, because investigation showed that a certain number of our jobs were well suited to this type of machining and would result in a satisfactory saving over planing. The whole situation was studied carefully, and the facts of the case proved conclusively the advisability of adopting this method of machining, which was then new to our shop.

Two new universal turret lathes were purchased when investigation showed the following facts: Two hand screw machines were wholly depreciated and were in a worn condition, being no longer capable of doing the more accurate work. Repairs were amounting to over $700 per year. Overhauling would cost about $1,600 each and then we would still have belt-drive machines. An opportunity to sell the machines for $1,300 each had presented itself. A 20 per cent increase in production could be obtained by the new machines, and a 5 per cent increase in price was just around the corner. With these facts available it was easy to make the decision to replace the old belt-drive machines with new motor-drive equipment.

New Radial Drills Replace Upright Drills

The principal reason for making this replacement was the fact that the old upright drills were becoming badly worn and inaccurate. However, the substitution of radial drills gave us more accessible, powerful and accurate machines adaptable to a wider range of work. The increase in production in this case was not so pronounced. It did, however, improve the general tone of the shop equipment.

Two New Boring Mills

In one case, lack of capacity necessitated two new boring mills. One of the old horizontal boring mills had been disposed of during dull times with the idea of replacing it when we became busy again. That time had arrived, as we were working 85 hours a week overtime in that department in order to get out the work. There was also evidence that new designs of our product then on the way would probably increase the boring mill work over anything previously experienced. It was therefore decided to purchase two new boring mills, which not only enlarged our capacity but gave us larger and more powerful machines with a number of niceties we had not possessed before. More capacity was the deciding factor in this instance, rather than greater production per machine.

A Drill Grinder Pays for Itself

Again a new drill grinder paid for itself in two years. Our drill grinding equipment was not worn out but the claims by the manufacturer of a large increase in the number of holes drilled per grinding, savings in power consumption on the drilling machines, less breakage and wear and tear on drilling equipment, and more accurately drilled holes warranted investigation. It was found that other concerns were realizing on the savings as claimed. The machine could be placed on trial for 30 days and should pay for itself in a few years' time. There seemed to be nothing to lose and everything to gain, and it is needless to say that approval was obtained at once.

Spending Money to Obtain A Better Looking Job

The paint on an automobile doesn't make it operate one bit better whether it has a good paint job or a poor one. But the value of a good paint job is a very vital factor when it comes to the sale of an automobile. While this may not be true to such an extent in the case of machine tools, still it cannot be denied that the appearance of a machine tool does have an appreciable effect on sales. Because lacquer withstands the ravages of soda in the coolant used, it was decided to equip for painting Norton machines with lacquer, a process that is recognized as the latest word in the painting of machine tools today. There were no tangible savings to balance against this outlay. It was only a case of giving our customers a better product with the hope that our efforts to give them the best would reflect themselves in future sales. This is an example, like many others that might be mentioned, of building up a good reputation in the machine-tool world.

REPLACEMENT DATA – NORTON COMPANY – GRINDING MACHINE DIVISION

All Figures in Dollars	New Machine A	New Machine B	New Machine C	New Machine D	Old Machine E	Old Machine F	Old Machine G
Machine cost	29,285	21,970	19,195	19,404			
Freight and installation	2,150	1,650	1,675	1,500			
Machine cost, installed	31,435	23,620	20,870	20,904			
Second hand value as old equip.	900	500	500	500	500	450	330
Total machine investment	30,535	23,120	20,370	20,404	500	450	330
Tools and fixtures	1,500	250	250	250	0	0	0
Total cost tequipment	32,035	23,370	20,620	20,654	500	460	330
Annual depreciation	3,203	2,337	2,062	2,065	0	0	0
Floor space value	2,050	1,720	1,720	1,720	1,650	1,650	1,575
Power cost per year	620	275	250	250	288	233	250
Repairs	50	35	35	35	500	400	600
Total yearly cost	5,923	4,367	4,067	4,070	2,438	2,283	2,425
Labor value	6,450	4,400	4,025	4,025	3,200	3,200	2,800

EXHIBIT K

Example of the type of information presented for the consideration of the manufacturing equipment committee

General Results Attained

The examples of replacement enumerated above constitute an attempt to illustrate the large variety of reasons that affect replacement decisions at the Norton Company, and the results to be attained by active but sensible replacement policies. Perhaps the greatest advantage to be gained by any well-executed replacement policy is lower costs. Every manufacturer wants lower costs and there is no more fertile ground for him to search for them than his equipment. The Norton Company has kept its equipment up-to-date and is always watching for the improvements that are continually appearing in the machine-tool world. We watch our older equipment for signs of deterioration so that the new improvement in design may be taken advantage of at the earliest time consistent with good management.

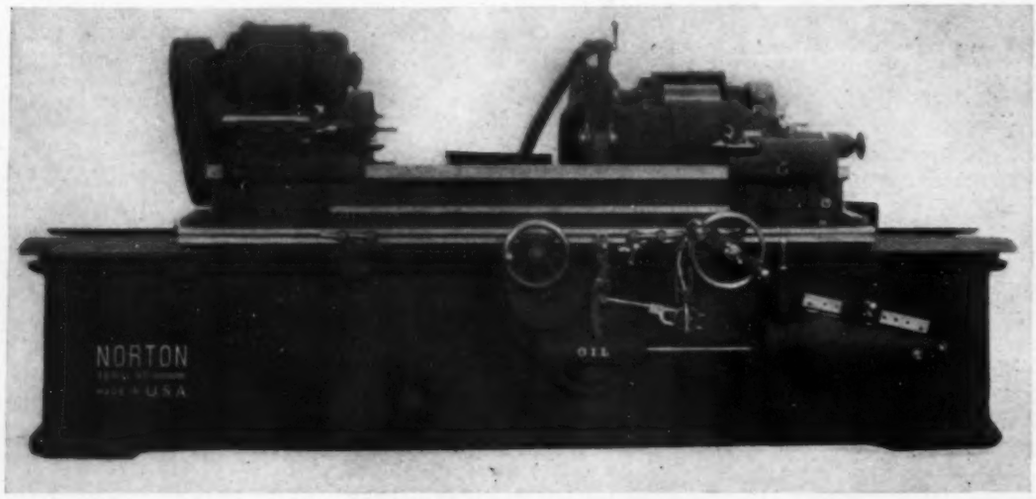
Another important advantage to be gained is quicker and better service to our customers. We have made big strides in this direction during the last few years, and while good planning, scheduling and control are responsible for its share of credit for this performance, still it cannot be denied that more efficient machine tools will add their share of improvement to the best planning system in existence. To keep the promises given to customers is one of the best ways to build up a business reputation, and a good replacement policy will help to do just that.

The demands of the machine-tool trade of today are for more accuracy and ever-decreasing tolerances. We are forever striving for a better and still better product, and this cannot be accomplished with worn-out and obsolete equipment. Better and more up-to-date equipment will produce a better and more up-to-date product —and so we pass on to our customers what we receive from our machine suppliers, and the circle of service is complete.

Good mechanics like to work with good machine tools. It therefore follows that a shop which believes in keeping its machinery up-to-date will attract the best workmen. It can demand the best and get it from a satisfied group of employees.

Our replacement policy has increased our productive capacity at least 15 per cent. Along with a program of a careful rearrangement of the plant, it has reduced the floor space so that we now have the necessary floor space for at least a 20 per cent expansion without the addition of any more buildings.

The slogan of the day is "Put your house in order. Replace your inefficient machinery with the newer, more efficient machinery now available." It is a good slogan. We advocate it. We believe in it. In other words, we practice what we preach. And, having practiced it, we intend to control it by a replacement policy that will insure its continuance.



Norton builds grinders in 300 types and sizes

STANDARD SHAPER TIME TABLES—SET-UP

Job Allowances

	Per Job, Min.
Table Set Up	8
Simple Vise Set Up	5
Div. Head	10
Angle Iron	8
Simple Fixture	10
Complex	15
Diff. Fixture	35
Large Angle Plate	8
Small Angle Plate	7
V-Blocks	7

Set Tool on First Piece

		Min.
This will be used mostly on keyways and slots	Plain	2
	Medium	3
	Diff.	5

Tool Adjustment

	Per Cut
*Change tool and set cut with measure	1.20
*Set first cut with measure same tool	.85
Raise tool by head feed (rough)	.10
and start next cut (accurate)	.18
Raise tool by head feed and return table for next cut	.30
Shift head	.35

***Rate Setter's Note**

These two units can be applied in the Set Up or in the Per Piece Time depending on the job requirements.

Exhibit G, Norton Prize Brief
See page 734, this number

Measuring Allowances

		Per Piece, Min.
Using Scale	Simple	.25
	Medium	.5
Using Micrometers		1
Using Verniers		1.5
Using Bevel Protractor		2
Using Indicator	Simple	1
	Medium	2
	Diff.	5
Using Gage		.5
		1
		2

Level and Square Up

	Min.
+/— 1/64 in	.25
	.5
	1
+/— .010 in	1
	1.5
+/— .005 in	3
+/— .0005 in	4

Place, Remove and Handle

	Per Piece, Min. Rough	Finish
Vise	.50	.75
Shift Piece in Vise or	.25	....
Shift Piece on Angle (one bolt)	.25	....
1. Straight Clamp or Bolt	.75	.95
2. Straight Clamp or Bolt	1.25	1.50
3. Straight Clamp or Bolt	1.75	2.00
4. Straight Clamp or Bolt	2.25	2.50
1. C-Clamp	.90	1.15
2. C-Clamp	1.64	1.89
3. C-Clamp	2.38	2.63
4. C-Clamp	3.12	3.40
Extra C-Clamp	.50	....
Extra Straight Clamp	.65	....
Jacks 1	.15	.30
2	.35	.55
3	.55	.80
4	1.00	1.50

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STANDARD SHAPER TIME TABLES—CUTTING

Cut	1/16 In.		1/8 In.		1/4 In.		1/32 In.		Finish Cut		Head Feed		Head Feed	
Length of Stroke	Rough Cut .062 In. Feed		Rough Cut .037 In. Feed		Rough Cut .025 In. Feed		Finish C.I. .200 In. Feed		.025 In. Feed		Rough .020 In.		Finish .010 In.	
	Strokes per Min.	Time per 1 In. Tool Travel	Strokes per Min.	Time per 1 In. Tool Travel	Strokes per Min.	Time per 1 In. Tool Travel	Strokes per Min.	Time per 1 In. Tool Travel	Strokes per Min.	Time per 1 In. Tool Travel	Strokes per Min.	Time per 1 In. Tool Travel	Strokes per Min.	Time per 1 In. Tool Travel
In.	118	.13	83	.33	83	.48	27	.19	118	.34	118	.42	118	.85
2	118	.13	83	.33	83	.48	27	.19	118	.34	118	.42	118	.85
3	118	.13	83	.33	83	.48	27	.19	118	.34	118	.42	118	.85
4	83	.19	59	.46	83	.48	27	.19	118	.34	83	.60	118	.85
5	83	.19	59	.46	83	.48	27	.19	118	.34	83	.60	118	.85
6	59	.27	40	.68	59	.68	27	.19	118	.34	59	.88	118	.85
7	59	.27	40	.68	59	.68	27	.19	83	.48	59	.88	83	1.20
8	40	.40	40	.68	40	1.00	27	.19	83	.48	40	1.25	83	1.20
9	40	.40	27	1.00	40	1.00	27	.19	83	.48	40	1.25	83	1.20
10	27	.59	27	1.00	40	1.00	19	.26	59	.68	27	1.50	59	1.70
11	27	.59	27	1.00	27	1.40	19	.26	59	.68	27	1.50	59	1.70
12	27	.59	19	1.41	27	1.40	19	.26	59	.68	27	1.50	59	1.70
13	27	.59	19	1.41	27	1.40	19	.26	40	1.00	27	1.50	40	2.50
14	19	.85	19	1.41	27	1.40	19	.26	40	1.00	19	2.63	40	2.50
15	19	.85	19	1.41	19	2.10	19	.26	40	1.00	19	2.63	40	2.50
16	19	.85	19	1.41	19	2.10	19	.26	40	1.00	19	2.63	40	2.50
17	19	.85	19	1.41	19	2.10	19	.26	40	1.00	19	2.63	40	2.50
18	19	.85	13	2.07	19	2.10	19	.26	40	1.00	19	2.63	40	2.50
19	13	1.24	13	2.07	19	2.10	13	.38	27	1.48	13	3.90	27	3.70
20	13	1.24	13	2.07	19	2.10	19	.38	27	1.48	13	3.90	27	1.48
21	13	1.24	13	2.07	13	3.08	13	.38	27	1.48	13	3.90	27	1.48
22	13	1.24	13	2.07	13	3.08	13	.38	27	1.48	13	3.90	27	1.48

FINISH CUT BASED ON 1/32 IN. DEPTH

Table based on cutting of cast iron

Conversion Factors for other materials

	M. S. & M. I.	Forg St.	Br. Cu.	Tool Steel
Cut	1	1	1	2
Cut off or Part	3	3.9	2.1	6

For All Cuts Except Keyways

For Keyway Cutting Times See *AM*—Vol. 75 page 581

Exhibit *H*, Norton Prize Brief

See page 734, this number

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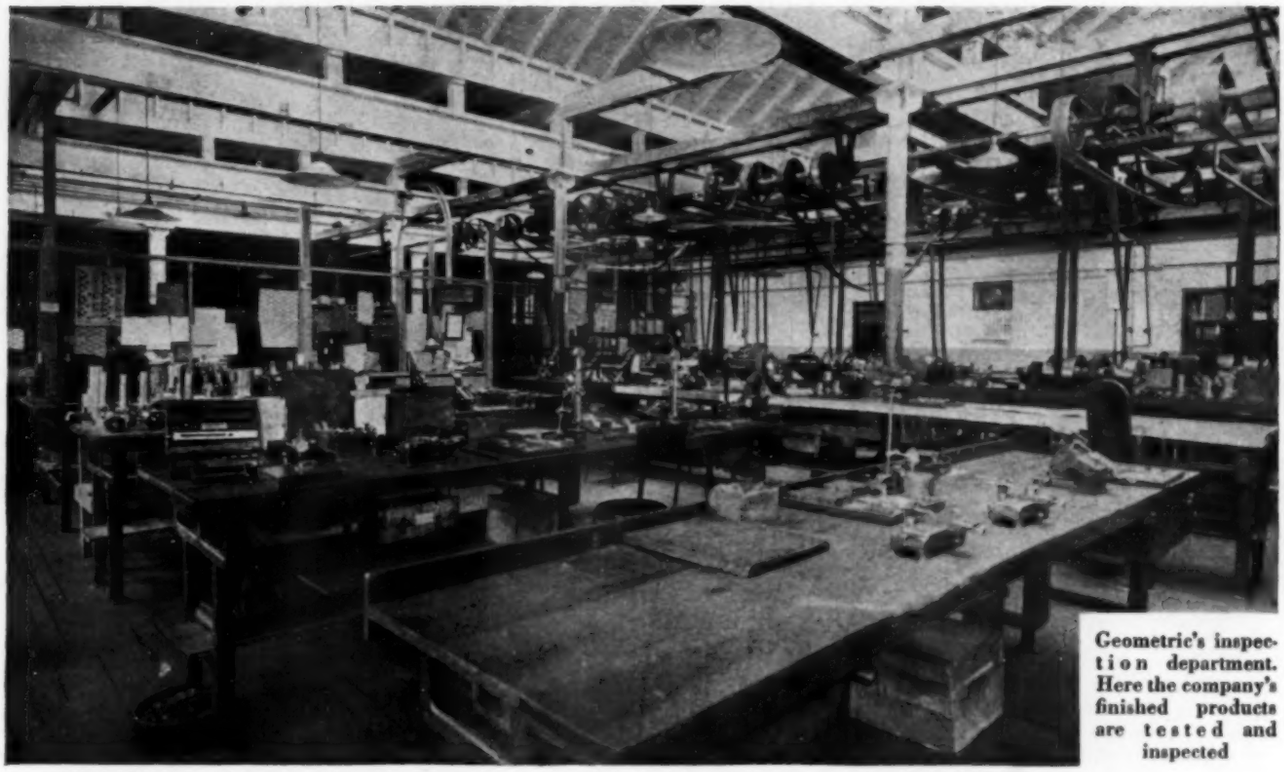


Geometric's inspection department. Here the company's finished products are tested and inspected

Replacing Equipment to Decrease Sales Resistance

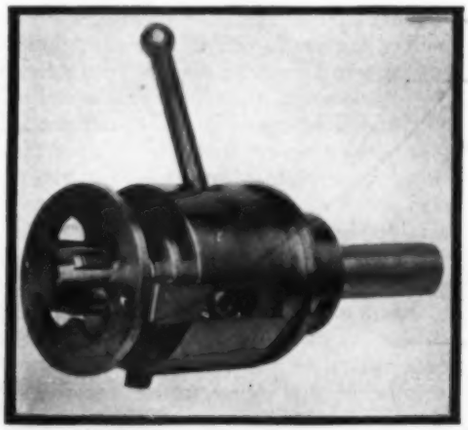
G. S. TRACY
Advertising Manager and Assistant Sales Manager, Geometric Tool Company

When the new owners and managers of Geometric Tool Company took charge in 1923, they put into effect a profound idea—"selling is not wholly the act of persuading a person to buy; it is principally the removal of resistance to sale from the product itself." Inevitably they developed a consistent and effective equipment replacement policy. Prize-winning brief for the *American Machinist* Award for 1931, Class II, companies whose average annual output is less than one million dollars.

EXAMINATION of the capital account of The Geometric Tool Company, New Haven, Conn., reveals that 66 per cent of the present investment in productive machine tools and 65 per cent of that in jigs and fixtures has been made since Jan. 1, 1925. Such an unusually high percentage of new equipment makes it worth while to discover the reasons why replacements were made and to ascertain what has been accomplished in the way of results.

The Geometric Tool Company began to make its present product in 1895. It was one of the pioneer companies in the field of making self-opening dieheads and collapsing taps. Today it is one of the largest exclusive builders of these products in the world. Products of the company can be summed up briefly by the phrase, "tools and machines for producing screw threads." Included under this heading are self-opening, taper cutting, and solid adjustable dieheads, and chasers for them; collapsible, receding chaser, and solid adjustable taps, and chasers for them; threading machines and chaser grinders.

Naturally, among the largest items of manufacture are the chasers or cutters for use in the tools mentioned. These chasers must be made of the finest grade of high-speed steel to extremely close limits. Since the strength of any mechanism held together by screw threads is no greater than the holding power of the thread itself, it follows that all vital dimensions and surfaces of the



One of the many types and sizes of Geometric threading tools

The machine shop. Notable is the great diversity of equipment required to produce the varied parts for threading tools

thread must be accurate and true to provide maximum strength.

Accurate and uniform pitch diameter, helix angle and thread form are requirements in a screw thread that test to the limit the equipment and skill of the plant that produces them. This is particularly true today when alloy steels that are stringy, tough and hard to machine are coming into such general use. These requirements place The Geometric Tool Company in the category of a manufacturer of precision tools. Since chasers must be made to accommodate a wide variety of thread forms and pitches—our stock ledger shows over 50,000 different combinations—as well as different dieheads and taps, equipment to produce them must be versatile to perform rapidly and to gage accuracy on a production basis. Accuracy and rapid production, therefore, are the impelling factors in our replacement policy.

Our plant may be divided into three parts: First is the machine shop, in which dieheads, taps, threading machines and chaser grinders are built. It contains engine lathes, screw machines, turret lathes, milling machines, gear cutters, broaching machines and drill presses, also a full complement of jigs and fixtures for duplicate production. Second is the chaser department, (chasers for dieheads are sometimes called dies) wherein much special machinery and equipment are used, in addition to milling machines, lathes, drill presses, grinders and cutting-off machinery. Third is the hardening room, fully equipped with the latest types of furnaces, controlling equipment and temperature recorders. Serving these three main divisions is a fully equipped tool room, filled with lathes, milling machines, shapers, thread millers, grinding machinery and other equipment, Superimposed on the whole shop is an elaborate inspection system, consisting of both floor and final assembly inspection, which not only checks and tests the merchantable product of the company, but also keeps a constant eye on machinery and checks all production gages, tools and fixtures by optical methods and master gages.

Methods Employed

A new approach to the equipment replacement policy of the company was made in 1923 when the plant fell into the hands of new owners and new management. They brought to the company one rather unique idea that had a profound effect. It was, simply, that selling is not wholly the act of persuading a person to buy; it is principally the removal of resistance to sale from the product itself. At first glance the two thoughts may appear to be identical, but analysis will show that they are not. Persuading a person to buy puts the whole responsibility upon the salesman; removing sales resistance divides the responsibility between the factory and the sales department and makes everybody in the company, from office boy to president, feel that he has something to do with making the product salable.

In getting this new idea across, the management invited all engineers and foremen to make studies to determine how to make the product better on the theory that making it better was one sure way of removing re-

sistance to its sale. Naturally this brought forth a crop of requests for new machinery, new jigs and fixtures and new and better small tools. The management did not discourage these requests, but ordered that they be carefully considered by the engineering department and reports made upon each. The latter were most revealing. Not only did they prove the inadequancy of the old equipment, but they also showed how old jigs and fixtures could be redesigned for faster and more accurate production. They also showed up dull and thoughtless foremen and made the engineering department look ridiculous more than once by emphasizing how negligent it had been in continuing to use equipment and methods so thoroughly antiquated and out of date.

The whole procedure acted as a stimulus in other directions as well. It "pepped up" the sales department, brought forth a complete new line of product to supplement the old, and gave the company twenty new patents within the three years. Its influence reached into our selection of raw material and resulted in doubling the strength of many tools without increasing weight. It also entered into our labor policy and brought about an incentive system that materially increased wages and production. Thus it can be said definitely that from one idea grew not only a replacement policy that has revolutionized our manufacturing methods and brought our equipment to a high state of efficiency, but also introduced other policies that have made this new equipment effective and justified its installation. New machinery does not avail much if it is not used, or if it is used improperly or if it is used for itself alone, and not for the purpose of making the product better. Thus we believe that a replacement policy, to be a real success, must embrace the replacement of antiquated methods as well as antiquated machines.

Out of all this experience, of course, there developed some fundamentals that epitomize the objects of our replacement policy. We may not have recognized them in the beginning, but we do now, and we look upon them as basic principles never to be lost sight of when new equipment is contemplated. We shall list them in the order of their importance.

1. Accuracy or quality of product.
2. Increased production.
3. Lower overhead.
   a. Reduction of floor space.
   b. Upkeep.
   c. Supervision.

It will be noted that accuracy is placed first and increase of production second. We, of course, seek both, but as between the two, means of improving our product is most important. Usually, however, where a machine is accurate it is also a rapid producer. In some cases new machines which we have purchased have paid for themselves in less than a year.

Like most companies, The Geometric Tool Company had and still has a reserve for depreciation of machines and equipment. This is based on a flat rate of 10 per cent per annum figured on actual cost. Repairs and all perishables, regardless of cost, are charged to current expenses. Book value of equipment, replaced by new before it is fully depreciated, is written off at once.

All machines and all capitalized equipment are tagged with a special serial number with a prefix to show age and a permanent record of each individual unit is made on an Equipment Record Card. This card is used to

Equipment No. 2901-527

Department MACHINE

DESCRIPTION One (1) Blank & Blank Co. No. 5 Universal H.H. Turret Lathe Complete with chuck, geared head, collets, pan and pump---equipped for motor drive, Serial No. G24550

	Date Purchased	Gross Price	Date of Capitalization	Value per Appraisal			Disposed of: Date	Disposed of: Depr'n Accrued	Disposed of: Book Value	Disposed of: Sold for	Disposed of: Loss or Gain
A	1/31/29	6001. 00	3/1/29	6,506.00							
B	"	14. 00									
C	3/3/29	14. 00									
D	"	14. 00									
E	3/11/29	10. 11									
F	4/24/29	70. 86									
G											
H											

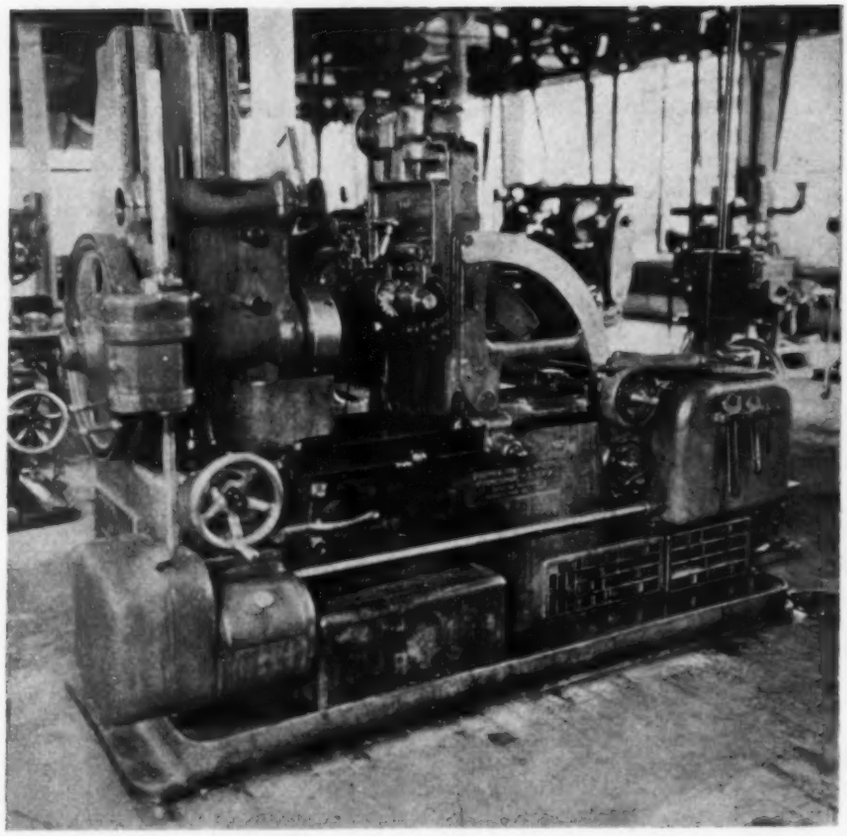
DESCRIPTION OF ADDITIONS

A Machine and equipment
B Bushings 4 inch
C " 2 9/16 inch
D " 3 1/4 to 4 1/4 inch
E Electrical Fixtures
F Chuck jaws

REPAIR RECORD

Date	Order No.	Nature of Repairs	Amount	Date	Order No.	Nature of Repairs	Amount
9/3/29		Cleaning & Repairing Chuck	8 98				
2/6/30		Repairing tool post	3 65				
8/3/30		" turret head	18 74				
2/1/31		" shift lever	1 13				

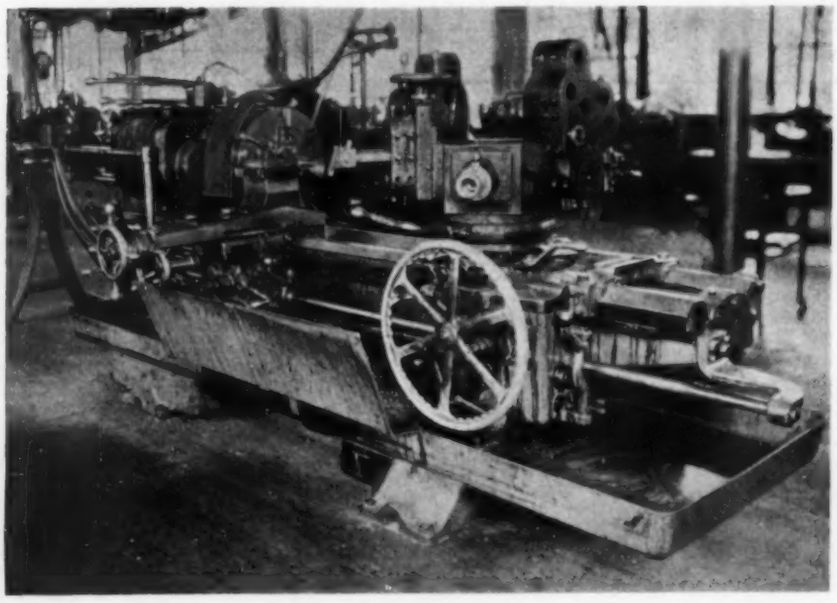
A permanent record of each unit of equipment is made on an equipment record card. A special serial number identifies each unit, and a prefix shows its exact age



This motor-driven spur gear cutter for milling chaser slots in tool bodies replaced two older units and increased production almost 200 per cent

describe and locate each machine and piece of equipment individually, and to record all vital information about it, such as cost price, appraised value, additions thereto and ultimate disposal. On the reverse side an itemized record of repair expenses is maintained. All of this information is taken into account when management considers replacement of the equipment.

Closely allied to equipment replacement, of course, is a study of costs to show machine and equipment efficiency. This study was made and a system established to give the cost of each operation and to enable us to allocate it to specific machines and equipment, as well as to specific operators. This led to time study and the establishment of a wage incentive system, with the result that that portion of our business producing 75 per cent of our sales volume is now operating practically 100 per cent on piece work.



One of five universal hollow hexagon turret lathes for rough turning tool parts. They replaced thirteen engine lathes and gave plus production

The establishment of the practices outlined above naturally brought to light errors in plant layout, in routing, in sequence of operations and manufacturing methods throughout the factory. With the installation of new machines, departments were relocated; aisle and bench space was economized; machines were realigned; tool cribs were centrally located and the whole plant layout thoroughly modernized.

Results Achieved

In the development of the program outlined, there have been two gainers. First, there has been a very material gain to The Geometric Tool Company and its employees. Second, there has been a distinct gain for Geometric's customers. Therefore, the results will be treated from these two standpoints. First, let us consider what Geometric has accomplished in its own behalf.

Modernization of Equipment

As stated previously, 66 per cent of the present investment in productive machine tools, and 65 per cent of that in jigs and fixtures, represents purchases made since Jan. 1, 1925. If we eliminate the small, occasionally used machine tools set up for special operations and rarely used, the actual number of productive machine tools in our shop that are new since 1925 represent 57 per cent of the total. A conservative estimate shows that this new equipment produces well over 75 per cent of our output.

We have purchased 106 new machine tools since that date, replacing 109 old ones. This statement needs some amplification, for at first it may appear that the new equipment was no more efficient than the old. Such is not the case, however. Not only were old machines junked and replaced by new ones on the regular line of production work, but in addition new lines of work were added. For example, in 1924 The Geometric Tool Company made but one general line of dieheads, known in the trade as the D type line. Since that time an entirely new line of tools has been added, consisting of thirteen sizes of rotary self-opening dieheads of two types, some fourteen sizes of stationary self-opening dieheads of two

The grinding room. All equipment is used solely for chaser grinding. A motor-driven surface grinder, installed to replace three smaller units, turns out 30 per cent more work than did the three together

The chaser department. In the foreground are new individual drive milling machines. One of these, an automatic miller, does 30 per cent more work than the four broaching machines it replaced

The cut-off room, with stored steel readily accessible. Two of the four new power hacksaws are shown. They replaced six cut-off machines to double production, save floor space, and reduce material loss

types, and eight sizes of solid adjustable dieheads. This new line not only materially increased our business, but being different in design from anything we had made before, it also required special production machine tools for its manufacture.

The chasers, too, were entirely different, requiring new machines for certain operations. On all collapsing tap chasers, one finishing operation required eight new machines. Other chaser operations requiring a lesser number of machines have also been added since 1925.

Where new machines were replaced the results obtained were, in some cases, quite extraordinary. A few examples will suffice to show this.

Five Replace Thirteen

In one case, five new universal hollow hexagon turret lathes were installed in the machine shop for the rough turning of the parts of tools. These replaced thirteen engine lathes. The five new machines are doing not only what thirteen machines were doing previously, but they are actually turning out more work per day. Production increased 200 per cent. By use of power feed cross slides and combination tooling it was possible to perform many more operations at one set-up, thus eliminating costly rehandling for second operations in many cases, and in all cases cutting down the extent of rehandling. The labor cost was also cut down with only five men being employed to turn out the same work done previously by thirteen. Faster speeds and feeds made possible much greater production per man hour on even a single operation without giving any consideration to the multiple tooling already mentioned.

One Replaces Two

Another example of new tool savings in the machine shop was the installation of a modern motor-driven spur gear cutter to be used in milling chaser slots in diehead and tap bodies. This one machine replaced two milling machines and increased production nearly 200 per cent. There was naturally a marked reduction in floor space. One operator instead of two is required, and he works only part time, since the semi-automatic machine enables him to run other machines at the same time. The work is held to closer limits and thus results in a better product.

A Grinding Example

The grinding room furnishes another example. There, a motor-driven surface grinder replaced three smaller surface grinders with a resultant saving in floor space. Even though one machine replaced three, the one ma-

chine turns out 30 per cent more per week than did the three machines previously. This production increase was made possible because of the greatly increased load facilities plus faster table and spindle speeds. Two operators were eliminated by the installation of this large surface grinder as well.

An installation of new machines in the cut-off room brought about a new and unusual kind of saving. Here the purchase of four new power hacksaws of the blade type replaced six cut-off machines equipped with circular saws. An increase in daily production of approximately 100 per cent was brought about immediately through increased speeds. Not only was the floor space saving advantageous, but these machines also brought about a new kind of saving, that of material. The cut-off waste was reduced from $\frac{3}{16}$ to $\frac{1}{16}$ in. width on every bar of steel. Since the length of chasers varies from about $\frac{1}{2}$ in. up to three or four inches, this means a substantial saving in material in each chaser cut-off. Based on full load production, and full-time operation, 52 weeks a year, 50 hours a week, the possible saving in high-speed material, based on price of material saved less price of scrap, equals approximately $15,000 a year.

One more example comes to mind, this time in the chaser department. An automatic milling machine was installed in this department to replace four broaching machines. Formerly the keyway in the D type chasers and the plate bearing or shoulder on K type chasers were broached. With the use of the automatic milling machine these slots were gang-milled with one machine, giving a production per day 30 per cent greater than was obtained from the four machines previously. Limits were held to closer tolerances, spoilage was reduced and a better product was obtained. Incidentally, the services of two operators were dispensed with. Floor space was cut on a basis of 6 to 1.

Similar replacements with equally telling results have been made in all departments. A survey of the various departments with the percentage of new productive machine tools may perhaps be of interest.

In the chaser department 73 per cent (by actual number) of the productive machine tools have been purchased since January 1, 1925. In the grinding department the percentage is 62 per cent; in the cut-off room 100 per cent; in the hardening room 50 per cent, and in the machine department, where dieheads, taps and machines are made, 33 per cent of the productive machines are new. The low percentage in the machine department, however, does not give a clear picture. Fully eighty per cent of the production of that department comes from the new machines.

Reduction of Floor Space

Incidental to the purchase of new machinery supplemented by the relocation of old equipment and the rearrangement of tool cribs and aisle space, there has been made possible a marked saving in floor space.

Prior to 1925, 60,000 sq.ft. were devoted to actual manufacturing operations. Today only 35,000 sq.ft. are required. We do not claim that this saving was entirely due to the purchase of new tools, but it is a fact that replacement of old machinery by new gave us the opportunity to rearrange all of our equipment, much to our advantage.

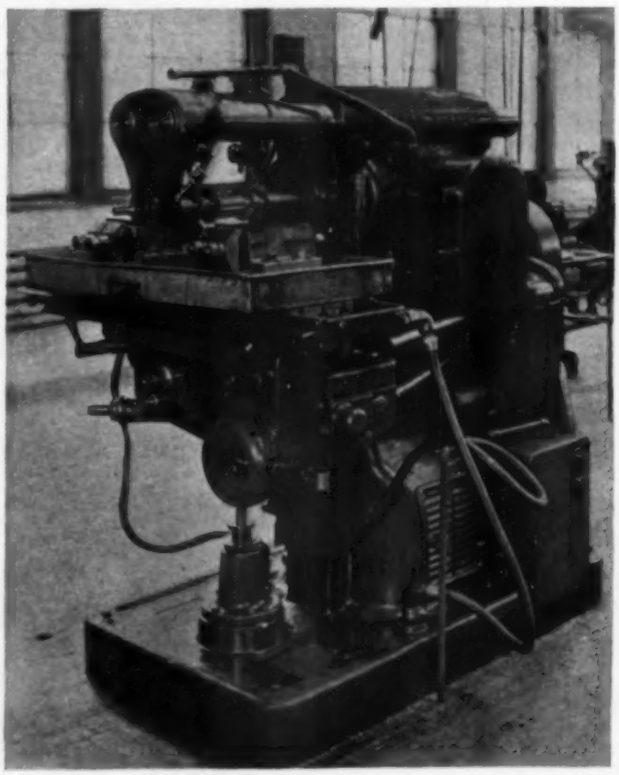
In an accompanying picture is shown the "bone-yard," formerly used for manufacturing operations. It is now used for storage of obsolete equipment. Another large room also formerly used for manufacture is now vacant and 80,000 sq.ft. of floor space on the second floor has been vacated because of the installation of modern machinery and methods.

Easier Handling of Materials

The purchase of new machinery resulting in decreased floor space required for manufacture has made possible a relocation of all manufacturing divisions. Prior to 1925, the steel was cut off into proper lengths on the lower floor, really in the basement of a building across an alley from the main plant. These parts were taken to the main plant to be milled and threaded, then hardened. The next operation, grinding, required the movement of parts back across the alley into another basement room. After grinding, they were taken back to the main plant for final inspection.

The layout of operations on chasers in those days was in accordance with accompanying chart No. 1. As can be seen readily there was a great deal of handling required with much time lost in going from one department to another. This was not only time consuming, but costly as well. By relocating the manufacturing departments the flow of work follows the various operations very nearly in a straight line. Obviously such an arrangement speeds up production and cuts down handling costs. The present layout is shown in chart No. 2.

What has been accomplished in chaser manufacture has also been accomplished in the machine department, where the parts of tools and machines are made. At one time both upper and lower floors of the main plant were used in machine manufacture and assembly with several rooms used for manufacture. Now all manufacturing is done on one floor, in one room. The assembly department has been located next to the final inspection department, thus giving true straight-line production.



An automatic milling machine, used in milling chaser keyways. It replaced four broaching machines and increased production 30 per cent

Production

Thanks to the machine replacement program, The Geometric Tool Company finds itself able to turn out more work in approximately half the floor space. Based on actual production figures of 1924 and 1929, Geometric can now turn out twice as many chasers and three times as many tools.

Production Labor

The machine replacement program, while cutting floor space nearly in half and while doubling production (in terms of chasers, tripling in the case of tools), also showed a big saving in productive labor. In spite of increased operations, productive labor was reduced 15 per cent. In other words, this greater production was turned out with 15 per cent fewer workers.

Non-Productive Labor

Not only was there a saving in productive labor, but there was also a saving in non-productive labor. With the relocation of departments less supervision was required, enabling this one item to be reduced 25 per cent. The employment of floor inspection, in addition to a separate distinct inspection department (which formerly did all inspection work) maintained inspection costs at about the same level, but speeded up the flow of work very materially. Needless to say, there was a real saving in handling cost—an item of non-productive labor.

Plant Overhead

With the reduction of floor space employed in manufacture there naturally were brought about savings in heat, light and power. When, as and if the vacant floor space is sold or rented the saving in plant overhead will be still more noticeable and will make the benefits accruing from our replacement policy more evident.

Stock Turnover

As will be brought out later on, the cycle of operations was cut from weeks to days. Thus is was possible to maintain a smaller inventory and turn the stock over more rapidly. From the turnover of twice a year prior to 1925, the present turnover has been increased to approximately four and a half times a year. The standardization of chaser sizes carried on under the auspices of the Simplified Practice Division of the United States Department of Commerce came within the period discussed and assisted the other factors mentioned in making possible a 50 per cent reduction in inventory. Needless to say increased turnover plus a 50 per cent cut in stock inventory made available a nice fund to pay for the new machinery that was the basic reason for these economies.

Spoiled Work Reduced 50 Per Cent With Tolerances Tightened

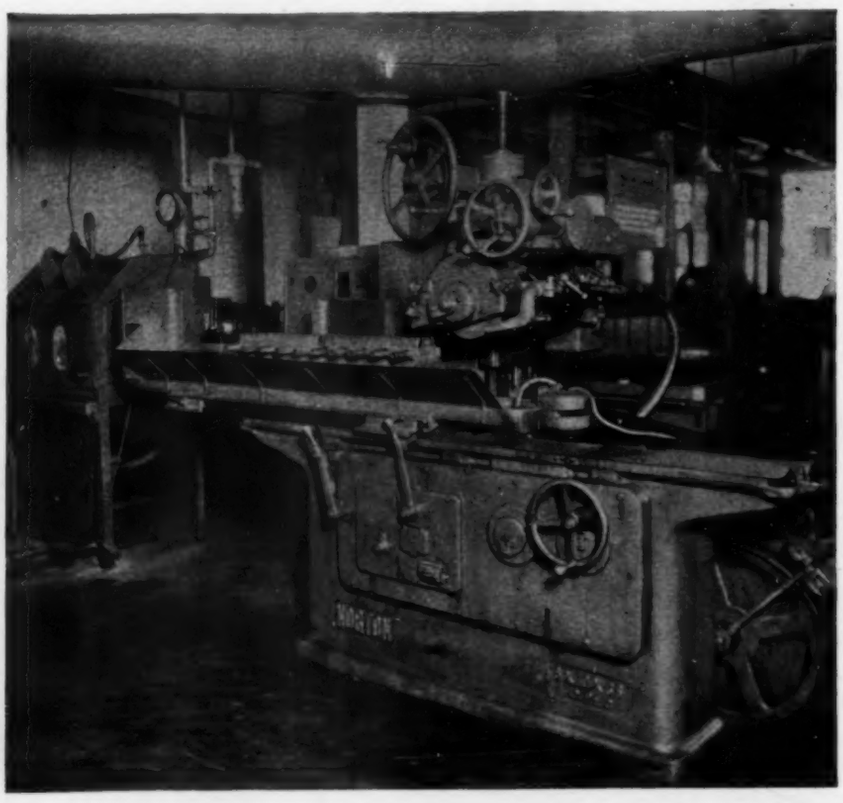
With the installation of new machinery there was a marked reduction in the spoiled work account. Today it is less than 50 per cent of what it was prior to 1924 (based on an equal volume of work, of course). This is all the more remarkable when it is known that the introduction of new machines brought a tightening up in tolerances all along the line. Where thousandths of an inch were units of measure before, tenths of thousandths are used today. It is estimated that permitted variations from standard are today less than one-third of what they were prior to 1925.

Wages

While the labor charge as a whole has been cut as has been pointed out, the wages of the individual employee do not show a reduction. The introduction of new machinery made possible the establishment of an incentive system of wage payment. Time studies were made and rates established with the idea of giving each worker a chance of easily making his old base rate (day rate) and at the same time giving him an opportunity of increasing his income by an amount dependent upon his skill and his industry. A study of all individual cases coming under the wage incentive system shows that the average income of the workers has been increased 25 per cent over and above their base or day rate.

Gains by Geometric's Customers

Much has been said of what the replacement of old machines with new has meant to The Geometric Tool Company. To be economically sound, advantages must also accrue to the customer. Let's see what the users of Geometric products get today that they didn't get in 1924.



This motor-driven surface grinder replaced three smaller units, saved floor space, and increased production 30 per cent

The hardening room. Visual and mechanical heat controls permit holding heats to a tolerance of 5 deg. F. Ample floor space permits ready handling

The plant "boneyard"—floor space formerly used for manufacturing; now a storeroom for obsolete tools

More Accurate Products

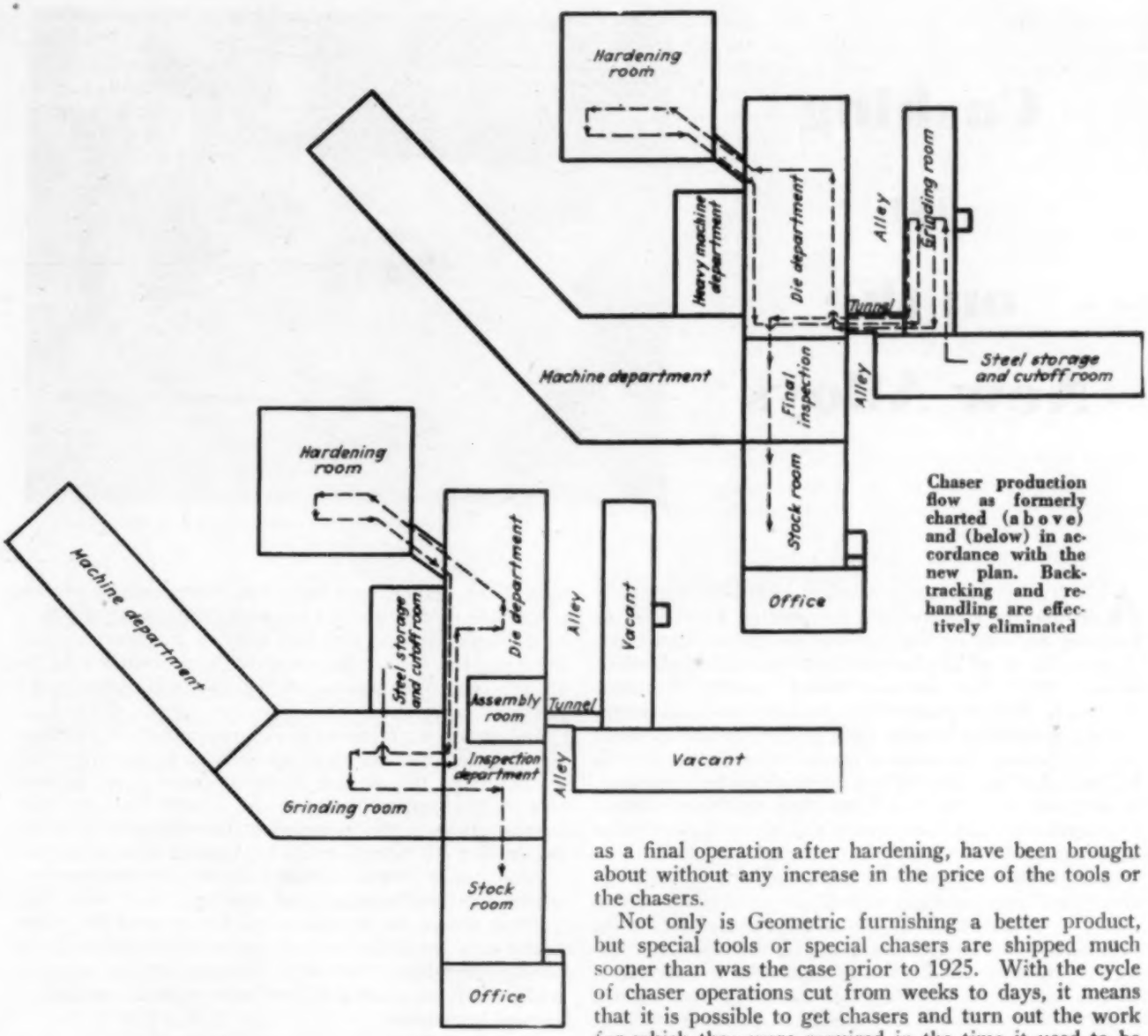
As has already been briefly touched upon, the installation of new machines made possible the introduction of the "tenths of thousandths of an inch" idea. Geometric chasers are made to much closer tolerances today. On an average, limits are less than a third of what they used to be. The thread form is more accurate and incidentally some of the new equipment included testing machines that will show, by means of light rays, errors of a millionth of an inch. The lead of the chasers is more accurate. The move or advance from one chaser to the next is closer. The diameters are held to closer limits—less time is required in adjusting to size. The chasers fit more snugly in the tools. In fact, all limits on both tools and chasers have been reduced so that the customer gets a much more accurate product. That means more accurate threads, better fits, less spoilage, saving in assembly time, and so on.

More Lasting Materials

Not only did the savings effected turn Geometric from

Eight thousand square feet of floor space on the second floor, formerly required for manufacture—new machines and methods make this area available for future expansion

Still more vacant floor space. Prior to 1925 Geometric used 60,000 sq.ft. for actual manufacturing; 35,000 now takes care of increased production



Chaser production flow as formerly charted (above) and (below) in accordance with the new plan. Backtracking and rehandling are effectively eliminated

a losing to a successful company, but they also enabled the company to incorporate into its product more costly and more lasting materials. Where an ordinary machine steel was used in the manufacture of tools back in 1924, these same tools are now being made of alloy steels, steels that are tougher and that will resist wear and strain longer. Needless to say such material is not as easy to machine, so that not only is the raw material more costly, but the parts cost more to make. This increased cost has been absorbed by Geometric through the medium of better machines and better methods. To the consumer better material means a longer life from his purchase and more accurate results during the period of its life.

Better Finished Product

The introduction of new types of machines has made possible the performing of operations not done before 1925, for example, the grinding of chaser slots in dieheads and taps. This is a new, yet very important operation to the user of Geometric tools. Other added operation such as grinding keyway and lug slots in the chasers and grinding of the thread form on collapsing tap chasers as a final operation after hardening, have been brought about without any increase in the price of the tools or the chasers.

Not only is Geometric furnishing a better product, but special tools or special chasers are shipped much sooner than was the case prior to 1925. With the cycle of chaser operations cut from weeks to days, it means that it is possible to get chasers and turn out the work for which they were required in the time it used to be necessary to wait for special chasers. The study of the regular routing of chasers in 1924, against similar routing in 1931, discloses that the time has been cut to less than one-third of what it used to be.

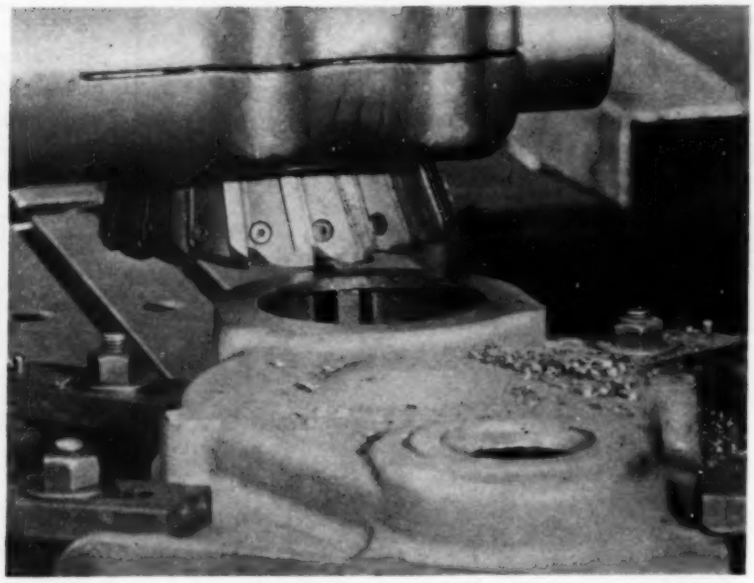
What has been said of chasers also applies to tools. Special tools can be made in half the former time.

Thus every Geometric customer is getting a better, more accurate, more lasting product at no increased cost and he is getting it much sooner than he did.

Summary

The Geometric Tool Company can well be proud of the results of its machine tool replacement program. A six-year program resulting in 66 per cent of its machinery capital account being charged to new machines, or to put it in other terms, with 57 per cent of all productive machines being new machines, has brought in its train some remarkable advantages. With a floor space of about 60 per cent of what it used to be, Geometric has doubled productive capacity on chasers, tripled productive capacity on tools. And, at the same time, it is able to bring to the consumer a better and more lasting product in half the time or less.

Cashing in on the New Alloys



ALTHOUGH various predictions have been made concerning the effect of the new cutting alloys such as tungsten carbide, or T-C, on the design of future machine tools, there have as yet been few radical developments. Beds have been stiffened, spindle diameters increased, driving gears made heavier, tool and work-holding devices made more rigid, and larger motors used; but the general appearance remains much the same as before. And in some instances, machine builders seem to rest content in the belief that their machines need no redesigning to hold their own in the use of T-C or other cutting tools.

A few machine builders and a number of machine users have been making practical tests of the new cutting alloys in actual work in the shop. These tests show that almost any kind of work can be machined satisfactorily and economically if the right tool is selected, if the machine can hold both the tool and the work rigidly, and if sufficient power and speed can be made available at the cutting tool.

An experience with high-speed tools bears out the advantage of mass and power in any machine work. Steel bevel pinion blanks about 3½ in. in diameter are cut from a bar. In a heavy turret lathe that will swing 20 in. or more, the tools turn out these blanks rapidly and with a smooth surface, formed at the proper angle. The same tools on a smaller lathe do not give a satisfactory finish because of the lack of power and rigidity in the machine.

T-C tools, say some, "are fine for cast ferrous metals and on non-ferrous metals of all kinds, but they don't work out on steel." Yet one large shop uses them in many operations on steel and is having special machines developed to handle more work, of steel. The operations include engine-lathe, turret-lathe, milling-machine and boring-mill work. Cutting speeds run up to 500 or more ft. per minute although the average is nearer 250. Cuts are light for the most part, which is as it should be. Why turn good metal into scrap unless it be absolutely necessary? Some work, however, such as turning a hex bar of about 2½ in. diameter, takes a ⅜-in. depth of cut with a feed of 0.018 in. per revolution on a 30-40 carbon steel at 275 ft. per minute. This turret lathe is driven by a 25-hp. motor, over twice the power usually put on a machine of this size. On one milling-machine job, a rotary-table machine with two spindles for roughing and finishing, the former time was reduced from 8 min. to 15 sec. per piece, because of the use of T-C tools and plenty of power.

Judging by experiments in progress and the practice so far observed, machine tools are likely to be powered with motors from two to five times as large as at present where maximum results are to be secured from the new cutting alloys. An 18-in. lathe, for example, is to be driven by a 50-hp. motor; a 75-hp. motor is being put on a 24-in. lathe. This involves a thorough redesigning of machine drives, bearings, and spindles. Some feel that gearing should be eliminated as far as possible. One heavy-duty lathe has but four gears in all, with a single back-geared drive. All other changes for this machine will come from a variable-speed motor, which makes d.c. current imperative.

The elimination of gearing is made in the endeavor to secure a smooth drive and to prevent vibration, just as has been thought necessary in grinding machine design. Gear experts, however, feel that gears can be cut sufficiently accurate to secure as smooth a drive as necessary even without grinding the gears. One engineer in fact, with excellent facilities for making tests of various kinds, contends that good, commercially cut gears will cause less vibration than results from some types of bearings when under load. In fact, the whole question of bearings and of types of machines may require new study if we are to multiply motor power and speeds by two, three, or five, as seems possible.

Plain bearings, it is claimed, require so much clearance when run at high speeds as to create undue vibration in some cases. Some large grinding machines with plain bearings have, however, been designed to run at about 100 deg. F. With these machines, it is necessary to run them long enough to warm the bearings up before starting to grind accurate work. Some designers are considering cone-type bearings, in which the end cones are adjusted while the machine is in motion, to give just sufficient clearance for running and yet be free from shake or vibration.

Then too, the high cutting speeds already attained are causing a careful consideration of their effect on the types of machines to be used in the future. Is it advisable to run heavy boring mill tables at speeds that will give from 500 to perhaps 1,000 ft. cutting speed, especially when the work itself is heavy?

As an alternative some are considering designing machines in which the cutting tools revolve. In one case, where shafts are to be turned with several shoulders, the tools are in a revolving frame, forming what is virtually a hollow mill. This method involves centering the shaft (if centers are desired for future operations) while it is being turned, either by a center drill in the tool fixture or a drill driven through the hollow spindle of the lathe or other machine which carries the tools.

These are some of the problems which are being studied by both machine designers and those responsible for still lower production costs. Will the solution result in strengthening of present designs, in modification of existing machines, or in new designs as suggested by the proposed method of turning the shafts previously mentioned?

Photograph courtesy Kearney & Trecker Corp.

NEW BOOKS . . . . . .

TAMING OUR MACHINES—*The attainment of human values in a mechanized society. By Ralph E. Flanders. 244 pages, 5½x8½ inches. Bound in cloth boards. Published by Richard R. Smith, Inc., New York. Price $2.50.*

Those of us who are devoting our lives to the study, creation and operation of machines will do well to pause occasionally in our efforts and take inventory of what we have accomplished, for good or ill, of what we are likely to accomplish if we continue along present lines, and of what the effect of our efforts on our civilization may be. Mr. Flanders' book represents such a pause on the part of one of the ablest of the engineers engaged in the design and construction of machine tools. He thinks as an engineer but, if the truth be told, it must be admitted that he expresses his thoughts far more lucidly than does the majority of the profession.

To develop his thesis Mr. Flanders goes back to the early days of invention and the first crude machines, explaning how the idea of the machine as a personal devil originated and how it persists in certain partly developed minds even today. He traces the cruel blunders of the exploiting class in the first stages of the Industrial Revolution and points out why the effects have differed in England and in the United States.

After commenting on the present attitude of men toward machines the author maintains that no decision pro or con can be reached unless we set up some sort of a yardstick of human ambitions and satisfactions. This he proceeds to do in a chapter called "The Good Life." He then points out how delicately balanced our modern mechanized society is and how subject it is to several well-known maladies—the cyclical depression, for one. Following this comes a comparison of Russian and American planning.

Space does not permit of further analysis of the interesting chapters on Business Stabilization, International Factors, Agricultural Relief, Raising the Standard of Living, Moral Problems, Economic Proposals, Beauty in the Age of Machines, and A Program of Human Values. The final chapter, We Approach the Crisis, demands a word, however.

In this last chapter Mr. Flanders goes back into human history and points out how five different cultures have flowered and decayed, showing much the same cycle of events. Our own culture has now reached a peak corresponding to the point in previous cycles where decay has begun to set in. Are we going to be able to avoid the fate of earlier cultures or must we, likewise, go down to ruin because of our inability to direct our destiny? The author is optimistic provided we make the most of certain current trends in economic, political, and sociological thought. His reasons are well worth careful study, as is the whole book.

INDUSTRIAL ENGINEERING AND MANAGEMENT—*By Ralph M. Barnes, associate professor of Industrial Engineering, University of Iowa. 366 pages 9x6 in. Indexed. Cloth-board covers. Published by the McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York, N. Y. Price $3.50.*

This book is intended primarily for the college class room. In common with all such books, it is profusely illustrated with stock photographs of industrial machines and equipment. It attempts to cover a broad field, extending from the design and construction of industrial plants clear through to manufacturing costs. In addition, it has several appendices dealing with general management. It follows usual practice in that it is largely a collection of data from various sources, but it is different from many in that it gives concrete examples taken from actual shop practice to corroborate and amplify the theory. This is refreshing after reading books by authors who merely compile material to fill a book, in the belief that "what is printed on the bottle must be so."

In the main the author confines himself to principles. This is wise because it eliminates the necessity for frequent revision. It seems to this reviewer, however, that too much weight is given to the subject of time study, motion study and other methods of incentive fixing. In using such methods, so much depends upon management, man and shop conditions, that their importance is likely to be exaggerated. As presented they afford the student no basis of comparison with each other or with efficiently supervised day work. The book as a whole is distinctly superior to the average text book, and its bibliography thoroughly covers the field.

THE EXPORT ORDER—*Written and published by G.A.F. Raland, 625 Center St., Elgin, Ill. Sixty, 6x9-in. pages. Paper binding. Price $1.00.*

From a lifetime of experience in foreign trade and matters of international law, the author has compiled information of interest to manufacturers doing or contemplating export business. The book covers such subjects as order sheets, addressing mail, ocean bills of lading, drafts, shipments, transportation, marine insurance, packing and marking, reimbursement terms, foreign customs regulations, credit information, establishing business connections, contracts, and much other information which is difficult to secure.

SHOP EQUIPMENT NEWS

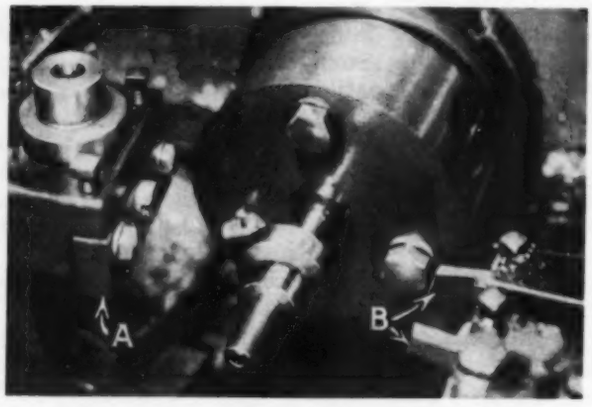
Prosser Widia Cemented-Carbide Tools for Cutting Steel

A non-cratering, cemented-carbide cutting metal developed especially for machining steel has been placed on the market by Thomas Prosser & Son, 15 Gold St., New York, N. Y. This material was developed by Fried. Krupp A.G., Essen, Germany, at the request of the importer for a steel-cutting carbide material to meet American needs. The composition permits increases in cutting speed when machining steel as great as those achieved with cemented tungsten carbide on cast iron and non-ferrous metals. This carbide product supplements tungsten carbide but does not supplant it, as there is no basis of comparison because of the difference in materials for which they are designed.

Details of the composition of this carbide cutting alloy are not yet available, but it is understood that a mixture of materials is used, and that a rare metal carbide not previously employed is embodied. The sintering process is used as for tungsten carbide. Uniformity in structure and freedom from blow holes are claimed.

A feature of this carbide alloy is the almost complete elimination of cratering action—the cupping out of the top of the tool back of the cutting edge caused by the pressure and abrasion of the chip coming off the work—which is sometimes so destructive to cutting tools. The chips slide off the surface of the tool with ease and are cut clean with no tearing action, resulting in less friction, so that the work remains cooler, and a much better finish is produced. Cutting speeds on steel two to five times as great as can be employed with high speed steel tools are claimed. However, it is stated that the material must not be considered a cure-all. It is essentially a high speed material, and best results will be had where the cutting speed can at least be doubled, using reasonably light feeds. Machines must be speeded up to take advantage of the increase in cutting speed available.

An important feature is that in case of accident, such as suddenly stopping the machine with the tool in the cut and the feed on, or where the tools are tested to destruction and breakage occurs, the edge of the tip flakes off in small pieces, rather than shattering and completely destroying the tool as formerly. Moreover, the machine can be stopped, the work gaged, and the machine started again without causing tool marks in the work.



Facing a machine steel bushing. The shaving tool is shown at *A* and the two facing tools at *B*. No regrinding was necessary after 5,400 pieces

Copper brazing of the carbide alloy to shanks can be done by the method employed for brazing tungsten carbide, and tips are supplied as usual to those desiring to undertake this work themselves. However, the tools supplied by Prosser embody a special shank steel and the tips are brazed by a special process, overcoming many difficulties sometimes encountered with tipped tools. The application of the carbide alloy to lathe type tools and milling cutters, as well as tool angles, are, as far as known at present, the same as with cemented tungsten carbide. The forms of the tips and the prices are also the same.

Grinding of the metal is at least as easy as the grinding of tungsten carbide, and the wheels and methods of grinding which are employed for tungsten carbide are applicable to the tools. It is necessary in some cases to grind chip breakers in the tools. In this case, care should be taken not to hollow grind the chip breaker, but rather to grind it parallel to the top surface of the tool with a small radius at the back to form the chip.

Tests on this material have been conducted both in this country and abroad. For example, a machine steel bushing was being faced on both ends as per standard practice at the rate of 1 min. floor to floor. The cutting speed was 280 ft. per min., and 200 pieces were obtained per grind. With a Prosser tool, the cutting speed was raised to 1,240 ft. per min. and the floor-to-floor time was reduced to 16 sec. After 5,400 pieces the tool did not require regrinding.

When machining a 3½-nickel-1½ chromium steel, tensile strength 156,000 lb. per sq.in., the regular tool being used cratered badly in 1¼ min. when operated at 200 ft. per min., 0.060 in. feed, and 0.4 in. depth of cut. With a tool of the new carbide alloy no sign of cratering was evident at 5 min. of operation. It is fair to say that the general run of cutting materials was not developed for modern cutting demands. This test gives a good idea of the characteristics of the new cemented-carbide product.

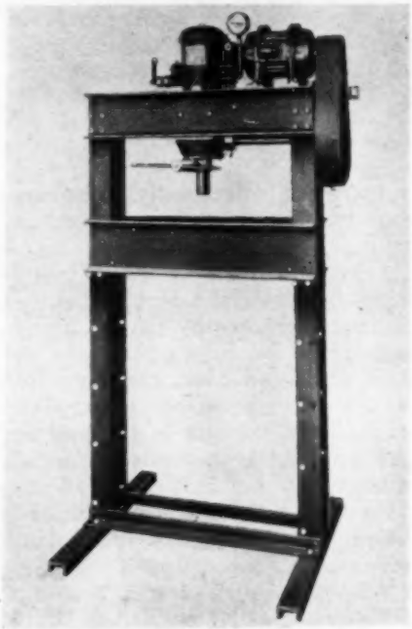
Improvements have also been made in Widia tungsten carbide. Grade N-349 is standard for general service. Grade H-201 is offered for chilled cast iron and other hard materials.

L-31 is extra hard for machining alloy irons and abrasive materials where close tolerances are vital. M-68 is for special, high speed boring and facing of certain materials.

Hannifin-Vickers Hydraulic Press

A general utility press equipped with a Vickers hydraulic pump and a control valve is announced by the Hannifin Manufacturing Co., 621 S. Kolmar Ave., Chicago. This Hannifin-Vickers hydraulic press is furnished in two types: hand-operated or motor-driven, and in three sizes of 20-, 40- or 60-ton capacity. The feature of the press is that the entire operating mechanism, including the cylinder, valve and reservoir are combined.

These presses are regularly furnished with the frame construction illustrated, but where desired a self-contained power unit may be purchased separately. It can also be furnished mounted on an open gap frame. The standard frames are so constructed that the motor drive can



be added later. The press is offered for those special jobs that come up at frequent intervals, which require the use of a powerful press.

The Hannifin Manufacturing Co. is also prepared to furnish high-speed hydraulic presses up to 100-ton capacity in two-column, four-column and open-gap types. These are also equipped with a Vickers hydraulic pump and control valve.

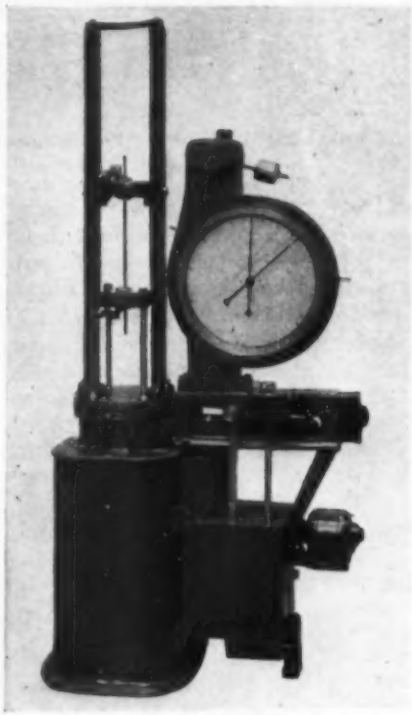
Olsen Hydraulic Universal Testing Machine

Hydraulic operation is featured in the universal testing machine just developed by the Tinius Olsen Testing Machine Co., 500 North 12th St., Philadelphia, Pa. The loading system consists essentially of a hydraulic cylinder and piston located in the base, the piston being connected to the four straining rods and terminating at the moving crosshead. As the pressure is increased in the cylinder, the lower crosshead moves down, tension load is applied through the specimen to the upper adjustable crosshead and then downward through the two side columns to the weighing table, which does not touch the four straining rods or any part of the straining system.

The weighing table rests on knife edges in levers. Through a system of levers the load is transmitted to a pendulum on the back of the upright housing at the rear of the dial. The amount of movement of this pendulum is shown by pointer on the dial, which is marked so as to read direct the number of pounds being applied to the test specimen. On the dial are two pointers, one of which moves forward or backward constantly as load is increased or reduced. The second pointer is drawn forward by the first pointer and always indicates the maximum load which has been applied to the specimen. The yield points are thereby shown clearly, and when the specimen breaks the second pointer remains at the breaking load until set back by the operator to zero position.

The knurled handle on the front of the lever housing controls the up and down movement of lower crosshead. The knurled handle on top of the lever housing under the dial is marked so that it may be set at various positions to regulate the "inches per minute" travel of crosshead up or down at various speeds. Automatic regulation is provided so that, as the load is increased, the rate of travel of crosshead is maintained. When the specimen breaks, provision is made for quick return of the crosshead to the top of its stroke, where it is ready for the next test.

The machine has direct motor drive and is practicaly noiseless in operation. The pendulum dial weighing system is so designed and arranged that it can be substituted readily for the scale beam weighing system used on the screw-driven Olsen universal testing machines so that anyone who



One scale pointer indicates the instantaneous load and the other the maximum, thus checking the yield point and the ultimate strength

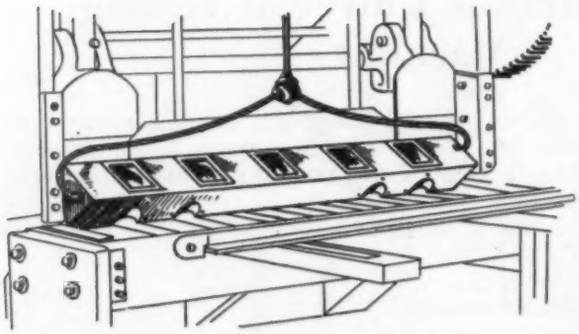
prefers the dial indicator to the scale beam can readily make the change.

The machine shown is of 20,000 lb. capacity, but larger machines of this type can also be supplied.

Surty Lighted Guard for Power Squaring Shears

An electrically-lighted guard for power-squaring shears is announced by the Surty Mfg. Co., Inc., 4139 Kinzie St., Chicago. It is attached to the frame of the shear at each end and is set so as to leave from $\frac{1}{4}$- to $\frac{3}{8}$-in. opening above the bed to permit passing of stock under the pressure bar and knife.

Pockets, half cup-shaped, are built into the guard at convenient spacing and extend through the openings in the pressure bar to within $\frac{1}{4}$ in. of the knife. This arrangement permits the



Surty Lighted Guard for Power Squaring Shears

operator to hold narrow strips of stock close to the knife blade without any danger of getting his fingers crushed by the pressure bar or amputated by the knife.

Safety glass is placed in the upper section of the guard and electric lights at each end on the under side so as to give the operator a clear view of the stock at all times and to allow the material to be cut to a line when a gage is not used. By attaching universal joints to the two base holding brackets at either end, any position of the guard can readily be obtained.

"U. S." Small Variable-Speed Floorstand Grinder

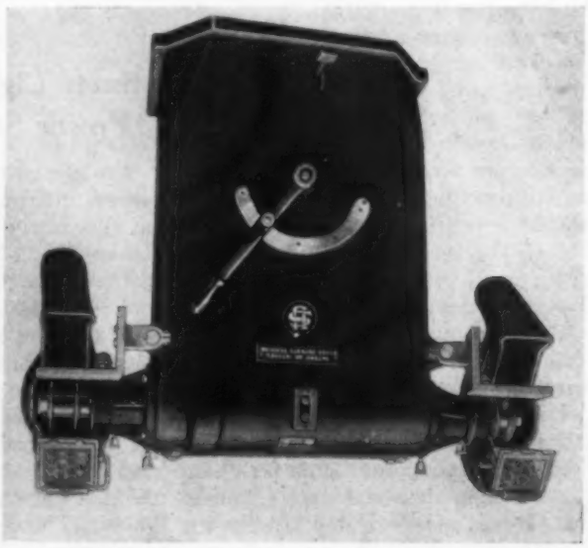
A smaller model of its variable-speed grinder has been developed by the United States Electrical Tool Co., Dept. 44, 2489 West Sixth St., Cincinnati, Ohio. This Model 64 grinder maintains a constant wheel surface speed regardless of wheel wear, and uses the wheels down to the flanges. Constant surface speed is accomplished by means of the patented Gibbs V-disk transmission of graphitized micarta. As the wheel wears, the operator shifts the device into the next spindle speed by means of a hand lever and pedal.

The grinder is built for continuous heavy service. Ball bearings are used throughout. Other features are the chrome - manganese motor shaft and wheel spindle adjustable cast steel wheel guards, and conveniently located push button control with no-voltage release. The four sizes supplied are available for wheels of 12x12, 14x3, 18x2 and 20x2 in. The motors are for 220, 440 and 550 volts, 25, 30, 40, 50 and 60 cycles, 2 or 3-phase, a.c.

Ramet Tantalum-Carbide Tools with Molybdenum Inserts

A new method of applying carbide tips to cutting tools has been developed by the Ramet Corp. of America, North Chicago, Ill., and is now being used on many of the tantalum carbide tools manufactured by this company and its licensees. An insert of pure molybdenum metal is brazed between the steel shank and the tantalum carbide tip. Molybdenum has almost the same coefficient of expansion as the tantalum-carbide alloy known as "Ramet," and the use of such inserts prevent strains being set up or cracks developing in the cutting tips as the tools cool after the brazing operation. Such strains as may develop between the molybdenum insert and the steel shank are absorbed by the molybdenum due to its ductility.

These inserts are desirable in tools where the carbide tips are long, thin, or of unusual shape, or where unusually severe conditions of operation are expected. In small tools the tantalum carbide tip is often mounted on a shank of solid molybdenum.



Olsen Ductility Testing Machine

An improved ductility testing machine has been announced by the Tinius Olsen Testing Machine Co., 500 North 12th St., Philadelphia, Pa. The motor drive is smooth in operation, and power is applied and the load weighed hydraulically. The cupping tool operating mechanism is similar to that used previously.

As the material is inserted and clamped in place, the thickness of the specimen is shown by the graduated scale under the hand-wheel. At all times during the test, the depth of cup and the amount of load applied are indicated. A stop is provided so that the increase in load is stopped automatically for any desired depth of cup. Then the load can be released instantly by a lever so that it increases up to the specimen fracture, at which time both the depth of cup and amount of load are shown.

"CP" Ring Valve Chipping Hammers

Only five major parts are used in the line of ring valve chipping hammers announced by the Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y. The valve is a simple band ring placed over the end

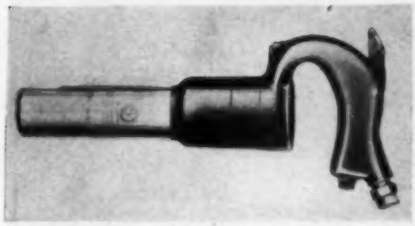


Fig. 1—"CP" Ring Valve Chipping Hammer, which is made in four sizes giving from 2,975 to 2,240 blows per min. and weighing from 11 to 13¼ lb.

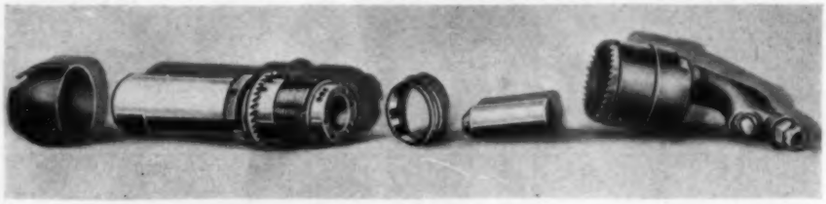


Fig. 2—Disassembled view of "CP" Ring Valve Chipping Hammer, showing the five major parts, which are: metal guard, cylinder, ring valve, piston and handle

of the cylinder and has a movement of $\frac{1}{64}$ to $\frac{1}{32}$ in., depending upon the size of the hammer. This construction permits elimination of the valve case and dowel pins. A locking device automatically tightens the handle.

As shown by Fig. 2, the assembly consists of the following parts reading from the left: First, the metal guard; second, the cylinder; third, the ring valve; fourth, the piston, the walls of which are perfectly straight, not grooved, and fifth, the handle. The tapered piston retaining wall in the cylinder conforms to the taper on the piston. The thick throttle lever does not cut into the operator's hands, and when depressed it is flush with the top of the handle.

PATENTS

OCTOBER 27, 1931

Metal-Working Machinery

Emergency Stop For Friction Screw Presses. Edmund W. Zeh, Newark, N. J. Patent 1,828,828.

Hydraulic Riveting And Bending Machine. Frederick J. Myers, Kansas City, Kans. Patent 1,828,874.

Screw Press. Stanley Hiller, Oakland, Calif., and Arthur E. Ozouf, Chicago, Ill. Patent 1,828,968.

Internal Radial Multiple Spindle Drilling Machine. Joseph S. Lach, Bridgeport, Conn. Patent 1,829,045.

Gear Cutting Machine. Leonard O. Carlsen, Rochester, N. Y., assigned to Gleason Works, Rochester, N. Y. Patent 1,829,263.

Chucking Machine. Arthur J. Lewis, Stratford, Conn., assigned to The Baird Machine Co., Bridgeport, Conn. Patent 1,829,284.

Tools and Attachments

Chuck For Broaching Steel. Charles C. Hansen, Easton, Pa., assigned to Ingersoll-Rand Co. Patent 1,828,862.

Adjustable Reamer. Charles L. Kessler, Rockford, Ill., assigned to Barber-Colman Co. Patent 1,829,485.

Chuck. Ernest J. Svenson, Rockford, Ill., assigned to Sundstrand Machine Tool Co. Patent 1,829,619.

NOVEMBER 3, 1931

Metal-Working Machinery

Control Device for Milling Machines. James Charles Potter, Pawtucket, R. I. Patent 1,829,943.

Means for Feeding Rivets of Special Section to Rivet Presses. Rudolph A. Skriba and Frederick J. Littell, Chicago, Ill., assigned to F. J. Littell Machine Co. Patent 1,829,967.

Fabricating Machine. Vernon B. Trevellyan, Evanston, and Wallace W. Smith, Chicago, Ill. Patent 1,829,971.

Cam Controlled Shaper Feed. William F. Zimmermann, Maplewood, N. J., assigned to Gould & Eberhardt, Newark, N. J. Patent 1,830,309.

Grinding Machine. Waldo J. Guild and Alfred P. Burns, Worcester, Mass., assigned to The Heald Machine Co. Patent 1,830,358.

Machine for Rebabbitting Connecting Rods. Charlie A. Brown, Christopher, Ill. Patent 1,830,423.

Spline Hobbing Apparatus. Hugo W. Jacobson, Arlington, and Raoul A. Demeillers, Upper Montclair, N. J., assigned to Gould & Eberhardt. Patent 1,830,659.

Drill Spindle. Charles F. Schenck, Cleveland, Ohio, assigned to the Toledo General Manufacturing Co. Patent 1,830,679.

Brake Drum Grinder. Amos P. Steiner, Waynesboro, Pa., assigned to Landis Tool Co. Patent 1,830,723.

Tools and Attachments

Abrasive Product and Method of Making the Same. Lewis E. Saunders and Lowell H. Milligan, Worcester, and Milton F. Beecher, Holden, Mass., assigned to Norton Co. Patent 1,829,761.

Method of Determining the Tensile Strength of Iron and Steel. Bror David Enlund, Degersfors, Sweden, assigned to Henning Enlund, Binghamton, N. Y. Patent 1,829,793.

Thread Gaging. James Hartness, Springfield, Vt. Patent 1,829,797.

Instrument for Exhibiting a Function of a Variable. Earle Buckingham, Belmont, Mass., assigned to the Foxboro Co. Patent 1,830,087.

Work Supporting Arbor. Edwin ance, Detroit, Mich., assigned to Packard Motor Car Co. Patent 1,830,130.

Grinding Fixture for Thread-Cutting Chasers. Albert F. Breitenstein, New Haven, Conn., assigned to The Geometric Tool Co. Patent 1,830,189.

Apparatus for Broaching Tractor Links. Edwin F. Longenback, Chicago Heights, Ill., assigned to American Manganese Steel Co. Patent 1,830,472.

Jig for Boring Connecting Rods. Adolph Storm and Thor Thorsen, Minneapolis, Minn., assigned to Storm Manufacturing Co. Patent 1,830,724.

Processes

Method of Making Welding Electrodes. Harold J. Horn, Trenton, N. J., assigned to John A. Roebling's Sons Co. Patent 1,829,933.

Process of Forming Cap Nuts. William R. Wiley, Detroit, Mich., assigned to Detroit Plating Industries. Patent 1,829,972.

Method of Making Finned Tubes. Harry W. Bundy, Detroit, Mich., assigned to Bundy Tubing Co. Patent 1,829,979.

Method of Cleaning and Pickling Metals. Waldo L. Semon, Cuyahoga Falls, Ohio, assigned to The B. F. Goodrich Co. Patent 1,830,566.

Method and Machine for Making Tubular Rivets and the Like. Oscar L. Smith, Toms River, N. J. Patent 1,830,722.

TRADE PUBLICATIONS

MOTORS. The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has issued leaflet 20516 on single-phase motors suitable for application to pumps, compressors, ventilating fans, and other equipment where high-starting and high-accelerating torques are necessary.

SHEET METAL DESIGN. The Youngstown Pressed Steel Co., Warren, Ohio, has issued "Adventures in Redesign," No. 3, showing many examples of redesign for sheet metal construction of household equipment, industrial equipment and other lines where better appearance, reduced weight, and cheaper cost have resulted.

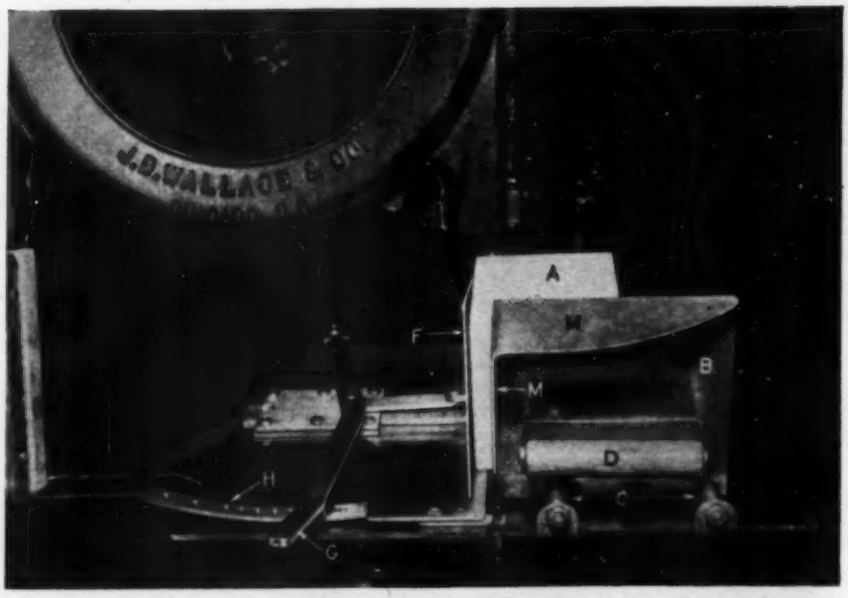
Sawing CO_2

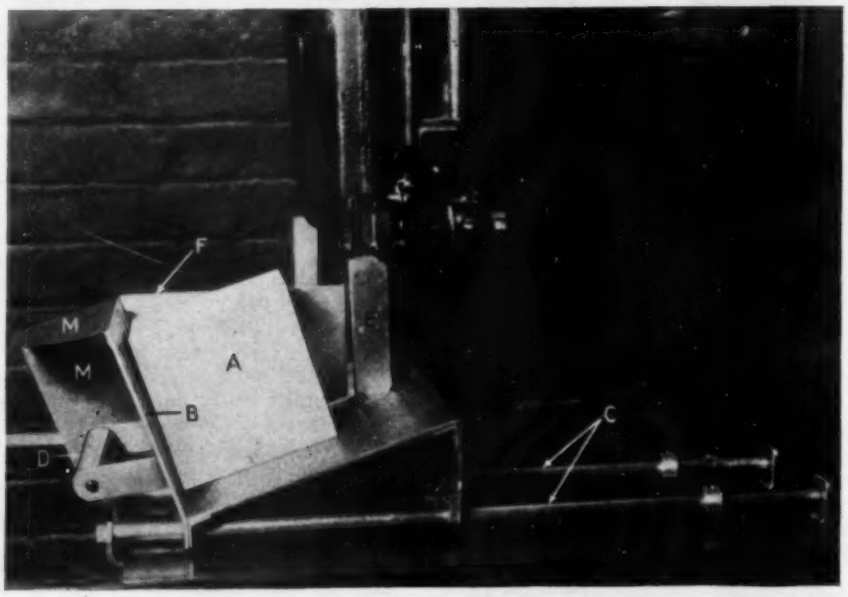
SOLID Carbon dioxide, familiarly known as "Dry Ice," has during the past few months made its debut in the metal-working industry. Since it seems destined for increasing use, the accompanying illustrations of a saw jig for cutting it may avoid repetition of previous difficulties.

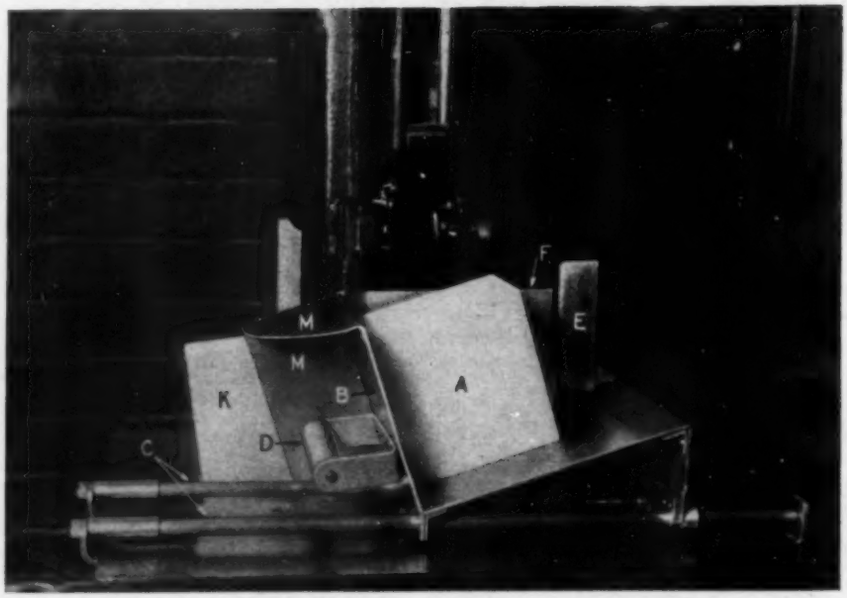
Solid CO_2 is most economically cut from standard 10-in. blocks by means of a bandsaw. The illustrated sawing jig saves time in cutting, saves ice by more accurate cutting, makes it possible to cut thinner slices, gages thickness of slices accurately, and reduces handling. *A* is the block of ice, *B* the front fence of the device, against which the ice rests by gravity, *C* rods on which the carriage slides—replaced in a later design by a single rod of rectangular cross-section—*D* the wooden handle for pushing the carriage, *E* the guard that covers the saw blade when the carriage is in loading position, *F* the adjustable gage fence which also serves as a guard for the sawblade during the cutting operation, *MM* the shield for the operator's hand, *G* the sliding handle that moves the gage fence *F* to vary the thickness of slabs to be cut, *K* a cut slab of ice, and *H* a quadrant or sector plate containing holes which engage an index pin on the under side of handle *G* to hold the gage fence in position so that uniform slabs may be cut. The rods *C* are adjustable for clamping to any saw table. Four caster rollers are attached to the underside of the carriage to supplement its support. The cut-off slab slides down the tilted table of the carriage.

Brass, bronze, or other non-ferrous metal, "stainless" steel, and ferrous metals with a corrosion-resistant coating may be used in construction. Moisture condensing from the atmosphere, coupled with the CO_2 gas given off by the ice, creates carbonic acid which will attack ferrous materials.

Other hazards might also be mentioned. The intense cold of the material (—110 deg. F.) causes frostbite or "burns" of parts of the body coming in contact with it.







Photographs courtesy The Travelers Insurance Company

AMERICAN MACHINIST

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

New York, November 12, 1931

VOL 75 NO. 20

No More Miracles

A friend who calls extensively on executives in the metal-working industry reports a general and reprehensible tendency among some of these men to sit back and wait for a miracle to bring them some orders. They tried, after a fashion, to secure business during 1930 when they were still buoyed up by false hopes that 1929 was a normal year, and that normalcy would soon return. By 1931 their tenacity of purpose had lapsed into despair, and effort ceased.

In the meantime their pugnacious competitors were out fighting for business, and getting what there was. And that is going to be the only way to get business for many months to come. There will be no more miracles.

A New Planer Paid for Itself in Thirty Months

A new manager of an old shop in a small town took his courage in both hands some little time ago and bought a planer. The less said about the tool it replaced, the better. Rumor has it that it was one of the vintage that wore grape vines for decoration. At any rate, the new planer soon showed that it would pay for itself in two and a half years.

Now planers do not ordinarily earn their keep so soon. It must be admitted that this was an unusually favorable opportunity for a new tool to show its merit. But it must also be admitted that there are quite a few of these old machines, not all of them planers by any means, that could be replaced to equal advantage. Perhaps there are several in your own shop.

In the two winning entries for the *American Machinist* Awards, which occupy the major portion of this issue, you will find expressed a philosophy of equipment replacement that casts a suspicious eye upon every productive unit in the plant, regardless of its age. That attitude, of course, represents the modern viewpoint—aggressive, forward-looking, willing to spend a dollar to save two. But to be able to buy needed replacement equipment one must have a sound financial policy which through careful planning has provided the wherewithal.

Not every plant has been so ably managed. But even though it be out of the question to reach the maximum desirable in modernization, there is no reason why every manager should not take steps to retire groups of fifty-, forty-, and thirty-year old machines, and replace them by a few pieces of up-to-date equipment. The opportunity for making quick and considerable savings is naturally greatest where ancient machines are still in use. A start with these tools is more than likely to change the financial picture so much that within a short space it will be possible to go after some of the younger but nevertheless obsolete units. Such a policy lays a sound foundation for future profits and for the establishment of a financial position that is well nigh impregnable.

Avoiding Set-Up Costs

Production men are frequently torn between the desire for a special machine and the knowledge that it can hardly be kept busy except in boom times. Certain operations require special set-ups on standard machines, and the time taken counts heavily in favor of special machines. On the other hand it is not easy to convince the man with the check book that it is wise to tie up capital in machines that are sure to be idle part of the time.

A compromise method of handling this dilemma is meeting with favor in certain plants: take a machine that has perhaps seen better days, equip it with simple tools and fixtures for the special operation, and keep it for that purpose alone, always ready for the job when it comes along. It

ties up little capital, the investment being paid for by the time saved at each set-up.

Taking such a machine out of regular production and replacing it with a modern machine for standard operations reduces costs, adds to the value of the plant and makes it far more easy to step up production as business increases.

◂◂ CHIPS ▸▸

It does not take the president of the Investment Bankers Association to tell us that a marked gain in general business is in progress . . . but his remarks take on added significance when it is remembered that the I.B.A. called the turn at the crazy height of the bull market . . . Wall Street has reason for feeling better . . . At least two billion dollars have been added to stock values by recent increases . . . By the end of October, the gross value of cotton carry-over and new crop went up 169,000,000 dollars; wheat, 263,000,000; corn, 307,000,000 . . . three quarters of a billion added to the purchasing power of farmers . . . Oil rises similarly . . . Bank clearings increase 4.4 per cent over last week . . . Bradstreet's reports that "the increase is due to better general business conditions throughout the country and cannot be confined to one particular section, as is usually the case" . . . The end of hoarding may be marked by decline of 24,000,000 of currency in circulation . . . Brokers' loans at lowest figures in ten years . . . more cash and credit should be available industrial requirements . . . Steel ingot production shows first increase of year . . . October production 44,774 tons over September.

President Hoover and the bankers continue to confer on defrosting frozen real estate assets . . . When a spare moment bobs up he presses efforts to untangle the Navy and budget . . . His special board of inquiry ducks the question of "abysmal ignorance" in naval affairs, but declares that the Navy League report "contains many inaccuries, false assertions and erroneous conclusions" . . . Navy League executive committee meanwhile indorses its own president's report by a vote of seven to one . . . Congress may appoint another committee . . . It now appears that the announced budget cut of 350,000,000 actually means that the new annual appropriations will be but 28,000,000 under current appropriations . . . the detailed figures should prove interesting . . . As members of Congress drift back to their offices on Capitol Hill, it becomes increasingly apparent to Washingtonians that civil service salaries are due for their ten per cent contribution to normalcy . . . Republicans will be glad that Democrats have won the responsibility . . . plus many others equally as full of dynamite.

> An accessory manufacturer states that automobile builders are buying so closely that, in his judgment, they will eventually have to make most of their own accessories and parts, simply because manufacturers will refuse to sell to them. Right now his own company will not sell more than fifteen per cent of its output to them.

Studebaker confirms report that it has placed a quarter million dollar order with Ingersoll Milling for a complete new cylinder block line . . . direct labor on blocks to drop 60 per cent . . . Federal Court permits National Cash Register to purchase assets of Remington Cash Register . . . declares that no monopoly will exist . . . Revenue freight moves 7,954 more cars . . . Graham-Paige October sales prove to be sixteen per cent better than last October . . . Colorado Fuel & Iron locates immense new iron ore body in Wyoming . . . will import no more Mexican iron . . . Chevrolet of Ohio reopens Toledo plant, recalling 1,500 day and night workers . . . California metal trades employment up, along with rubber, furniture and others . . . Electric current sales in middle west running 6.3 per cent ahead of last year . . . Southern states report increases in industrial activity . . . some call it a "climb" . . . Total U. S. shipments to U.S.S.R. so far this year practically equal last year in money value . . . exceed by far in actual volume, all Amtorg protestations and threats to the contrary . . . U. S. Cruiser "Indianapolis" launched . . . 65 per cent completed and will be commissioned next August . . . Airship "Akron" carries 207 passengers on record flight . . . former record of 169 held by Dornier DO-X.

Several observers profess to see that the advances in grain and oil prices are predicated on the threat of Russia's entering the Sino-Japanese War . . . she would naturally not be able to export wheat and petroleum . . . Fact more probably is that her mechanized harvests have been disappointing and that America's indigent unemployed have been burning up surplus stocks of gasoline . . . U. S. Department of Commerce negative attitude on Russian trading remains unchanged

. . . fifty per cent cash and balance within year still recommended . . . Liklihood that large private manufacturing and exporting interests will reopen the whole Russian import and export situation . . . and Washington will have to listen . . . Thus far we see no extended comment on the fact that the harvest season is in full swing in Manchuria . . . Japan is largely dependent upon Manchuria for food and raw materials . . . That the South Manchurian Railway is the only practicable common carrier must have much to do with Japan's refusal to "get out by November 16" . . . It is to be hoped that the new State Department installation of trans-oceanic telephones will not tempt the Secretary of State to undue participation in Far Eastern affairs and a possible break with Japan . . . To come closer home, business is undoubtedly booming in Great Britain . . . metal-working, textiles, coal—all going strong . . . Department of Commerce also reports improvement in Canada, Italy, Argentina, Mexico and Australia.

It appears that 97 per cent of 1932 automobiles will be wire-wheeled. Ford will stick to the welded wheel though the riveted wheel is cheaper and is as good. It seems that he spent a million or so advertising the idea and cannot see his way clear to changing.

THIS WEEK IN *AM*

An atmosphere of calm and relief pervades floor twenty-seven of the new McGraw-Hill Building. The bronze plaques, the signed certificates and the purses of gold are on the way to the two winners of the *American Machinist* Awards for 1931, and the goose hangeth high. We hope the winners and the less fortunate contestants feel as good as we do. Dexter S. Kimball, dean of engineering, Cornell University, will present the prizes this evening at a dinner meeting of the American Management Association, Hotel Statler, Cleveland, O. Philip E. Bliss, president, The Warner & Swasey Company, will preside. We wish that we might be present in person to congratulate all the representatives of Norton Company and The Geometric Tool Company. But someone must see that *AM* continues its fifty-four years of unbroken publication.

It does not, of course, surprise anyone that the lion's share of this issue is devoted to the winning briefs. By their intrinsic worth, they fairly demand publication in full. Two of the Committee on Awards most experienced in industrial affairs have stated that almost any company in the country could install either the Norton or the Geometric plan with full assurance of profitable results. They urge the fullest reading and rereading.

It should be interesting for you to know that Howard Dunbar, works manager, fathered the Norton plan throughout with the hearty support, encouragement and cooperation of W. LaCoste Nielson, vice-president, and his associates. This does not in the least detract from the fine work of Roy C. Blanchard in compiling, assembling and writing the brief as presented and published.

James W. Hook, president, The Geometric Tool Company, writes that individuals too numerous to list collaborated in the preparation of the Geometric brief. Again, this cannot be construed as any detraction of G. S. Tracy's excellent job as compiler, assembler and writer. Mr. Tracy has two titles, assistant sales manager and advertising manager. Mr. Blanchard is a member of Mr. Dunbar's personal staff.

• COMING •

Of one thing at least we can be well assured: the six successive forthcoming issues will each contain a leading article of genuine and substantial worth. The final runner-up briefs in the contest for the *American Machinist* Awards have the word of each member of the distinguished Committee on Awards as guarantee. Each insisted that the eight papers finally considered (including the winners in this issue) must be published in full. The order of publication will be alphabetical by classes: the S K F plan, Nov. 19; the Blanchard Machine Company plan, Nov. 26; Warner & Swasey, Dec. 3; Pittsburgh Gear, Dec. 10; Westinghouse Electric & Mfg., Dec. 17; and Rotor Air Tool, Dec. 24.

The issue of November 19 will contain in addition a thoroughly practical article on the subject of modified gravity curves for quick acting cams; a general statement of how best to utilize wage incentives in die making; a description of the new U. S. Army cross country combat unit; a Reference Book Sheet bringing the subject of magnesium up to date. With all the foregoing will come a report of the American Management Association meeting at which the *AM* Awards are being presented, together with photographs of the cast bronze plaques, the hand-lettered certificates and certain of the participants in the ceremonies.

THE . INDUSTRY .

Progress in Metal-Working and Machinery Markets

BRIGHT spots liven the tool sales picture in one or two sections, notably around Detroit. . . . Studebaker ordered a $250,000 cylinder block tool line from Ingersoll Milling. . . . The best other sections can do is hope for betterment to follow the present improving trend of general business. . . . Metal-working machinery exports set, however, a new high record in the first nine months of this year, exceeding last year's previous high by a million dollars.

NEW YORK sees no change for the better, although in one or two cases inquiries are up and one dealer had an exceptionally good week. . . . The Subway orders have not yet been released there. . . . Detroit's orders were for a few lathes and boring machines from some of the busy contract shops, but numerous inquiries are beginning to come in from automobile builders—and their inquiries usually mean something. . . . Chicago had an October gain after a poor September, chiefly in small tool sales. . . . Cleveland dealers confidently expect Ford's inquiries for accessories to start a chain of others from plants affected—including some requests for quotations on tools. . . . Some automatics were sold there. . . . Indianapolis sells a tool here and there to radio cabinet and furniture builders, and hopes to get some good out of prospects for $25,000,000 worth of new roads next spring. . . . Cincinnati still shakes a regretful head, although pausing to whisper of a rumor that the Government will buy.

NEW ENGLAND October totals gave no indication of tool sale progress. . . . Favorable prospects during the past week there, however, included small tool, aircraft, automobile body, clock and radio builders. . . . Pacific Northwest, while optimistic, has had mainly municipal orders.

NEW YORK

Tool sales are no better, and show little indication of immediate betterment. Most dealers look forward hopefully to an upturn in general business after the first of the year. Orders have not yet been released on the Subway list, nor has anything further been done on a group of tools for technical schools. Inquiries, with one or two exceptions, still drag, and used tools are a drug on the market. One dealer, however, had an exceptionally good week—the result of hard plugging.

DETROIT

A few orders for lathes and boring machines are being placed by contract jobbing shops, and numerous inquiries have been received from these shops and from automobile plants. Production on new car models will get under way this month, but no one expects the automobile builders to release orders for equipment. The most common prediction is that there will be no heavy sale of cars until spring. Even contract jobbers are extremely cautious about giving releases. They are busier now than they have been in two years but they do not know how long the rush will last. All available shop capacity is being utilized by the automobile companies in preparation for the production of new models.

CHICAGO

October tool business showed a slight improvement; the gain was chiefly in small tools, demand for important units having been kept down to bare necessities. There is little on which to base a forecast of a pick-up for this month. Reports are current that manufacturers of farm implements are overhauling their shop equipment with a view to increasing production at no distant date. Inquiries are about the same.

CLEVELAND

The local machine tool trade is displaying keen interest in the fact that the Ford Motor Co. has placed a large number of inquiries for parts with accessories manufacturers in this vicinity. They in turn have made some inquiry about tools and if they are successful in obtaining any orders new tools and equipment will be purchased. Otherwise, conditions remain unchanged. Automatic manufacturers made a few sales during the past week.

INDIANAPOLIS

Demand for machinery and machine tools continues spotted. One big disappointment is the absence of railroad buying. With the exception of one plant, business with the automobile industry is practically stagnant. Some cautious buying has been done by radio cabinet factories. Furniture factories have made some small purchases.

From present indications it would appear that mid-winter will see some real business done with contractors, particularly road contractors. The state highway commission has $25,000,000 to spend.

CINCINNATI

No improvement is noted either by manufacturers or selling agents. There is a rumor that the Government is about to place some fairly large orders, but this has not been confirmed officially. Various classes of users are merely making purchases that they cannot avoid, the requirements in nearly all cases being single tools for replacement. A fair number of inquiries are being received, but only a few are developing into orders.

NEW ENGLAND

Tool sales totals for October give no indication of general progress. Favorable factors developed during the past week, however, notably for small tool manufacturers, the aircraft industry, automobile body builders and clock and radio manufacturers. A Springfield concern reports good orders from France and England for small tools, with the general demand favoring band saws and drilling tools. Grinding machinery shows no progress.

CANADA

While there has been little change in market conditions, there have been a number of constructive developments. The steady rise in wheat prices gives hope to manufacturers of agricultural machinery. Recent statistics have shown a decided improvement in manufacturing generally, particularly in textile and newsprint plants. The electric appliance industry is entering a busy period, and sales have increased sharply. Leading bridge companies have orders to keep plants running for two months.

PACIFIC NORTHWEST

Increased inquiry is giving the machine tool and shop equipment trade a more optimistic tone. Some branches report a noticeable pickup. The year's total turnover will probably not be in excess of 50 per cent of 1930. Purchases in recent months have been confined almost entirely to public works and governmental requirements, but this month industrial inquiry, in small proportions, has begun to develop. Pickup is reported in auto tool equipment while marine installations, mining operations, including drills and compressors, and hand-to-mouth turnover in general lines have given dealers some business in small lots. Small wood-working tools, airplane factory equipment, and lathes are in better demand. Canning plants are idle and expect no new business until next spring. For a large government dam to be built at Cle Elum, Wash., contractors have purchased some equipment while the Puget Sound Navy Yard is buying two 20-in. lathes and has specifications out for a 3-in. plate bender.

WEEK . BY . WEEK

BUSINESS BAROMETER

Trends in General Business throughout the world

THEODORE H. PRICE
Editor, Commerce and Finance, New York

Within the two weeks just past the world's two greatest democracies have held national elections. The vote in Great Britain showed that the English people are getting tired of Socialism and its ways, while the vote in the United States indicated that the spread of so-called radicalism had been checked and that the people were less inclined to political experimentation than was supposed.

This statement justifies what John Stuart Mill wrote of the United States shortly after the Civil War. In substance he sajd that the American people when confronted by grave crises, often seemed upon the point of doing the wrong thing, but in the end the commonsense of the democracy has asserted itself in a national decision to do the right thing.

The elections of Nov. 3 vindicate the soundness of Mill's judgment. When the people grow restless and impatient for reform they often threaten to destroy the political structures that the Fathers built and bequeathed to us. Thus far, however, their threats have not been carried out, and the elections show that a very moderate dose of hard times has been speedily effective in reestablishing confidence in economic law as applied by the English-speaking peoples of the world. Upon details they sometimes differ, but their faith in essentials is entirely undisturbed, and the country will now await with equanimity the presidential campaign that will be fought out during the year 1932. It will be an active campaign, but there will be no economic heterodoxy on either side, and we shall have a very interesting opportunity to see whether Mill's confidence in the judgment of American democracy still holds good.

Commercial Activities Beclouded

The commercial and financial activities of the week have been somewhat beclouded by the dust raised during the elections and a few days afterward. There is, however, no denying that the feeling is more cheerful, and that the tendency is up rather than down. Wheat as well as most of the other staple grains have had a sensational advance. It is attributed to reports that Russia's exportable surplus will be much smaller than expected. This is, however, an apology rather than an explanation. The truth is that the mood of the speculative public has changed, and that the change is evidenced not only by an advance in grain, but by an advance in several other essentials, such as silk, sugar, coffee, hides and silver. The rise in silver has, in fact, caused something of a sensation, and is regarded by many as a harbinger of great economic prosperity for China, India and the Far East. It is peculiarly interesting and important just now because Great Britain has not made any statement with regard to the stabilization of sterling, and much depends upon what she will propose.

Prices More Resilient

Meanwhile, prices on the New York Stock Exchange are a little more resilient than they were. Declines are easily recovered, and there is no longer any disposition to go short or encourage short selling. The talk of a ten per cent reduction in railway wages has been welcomed by most railway executives. If such a cut can be made effective it will go a long way toward reestablishing faith in our railway securities.

Distributive trade in the United States is more active. The mail order houses, as well as the department stores, seem to be preparing for an excellent Christmas trade.

There is no denying, certainly, that the last ten days have seen an important reversal of feeling throughout the United States, and that merchants and manufacturers as well as farmers are coming to rejoice in the change of sentiment that is so obvious.

In Great Britain, Premier MacDonald has formed an exceedingly well-balanced National Cabinet in which extremists of all shades are conspicuous by their absence. Of the twenty offices, eleven will be filled by Conservatives, the two Liberal factions will have five, and National Laborites will have four. The ensemble makes for a program of sanely moderate economic reforms with which the ultra-Conservatives will do well to be content.

In the Far East the outlook is far less cheerful and grows more confused. Within ten days of the time fixed by the League of Nations for Japan to withdraw her armies to the Manchurian railway zone, which they have a right to guard, these forces have advanced further into Manchuria and fought a battle with Chinese forces, which were defeated with apparent ease. There is an apparent involvement of rights and wrongs on both sides which obscures the merits of the dispute and makes a suspension of judgment advisable. That Japan is largely dependent on Manchuria for food supplies is certain, and the disorders in China may have endangered the island empire in that way, but this scarcely entitles her to the control of that great territory, as large as Germany and France combined. Indeed, the Japanese disclaim any territorial aims.

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THE BUSINESS WEEK

November 11, 1931

Prospects of a general and vigorous upturn in business early next year have been strengthened almost to certainty by underlying developments during the past month . . . The devastating process of commodity price deflation appears definitely to have ended as credit expansion sets in in speculative channels and sharp reduction of supplies in some lines looms up for next year . . . This, together with return of hoarded currency to circulation and cessation of gold exports has eased the banking strain, lightened the pressure for security liquidation, and put the banks in a better position to support the inevitable re-inflation . . . The coming session of Congress, close at hand, is certain to supply further inflationary stimulus in all its 57 varieties by special financial relief measures . . . The British elections have opened the way to improvement in England, and France will obviously be obliged to offer financial first-aid to Germany before February . . . Year-end, new-model automotive activity and belated railroad buying have given some unseasonal stimulus to steel production . . . October residential building and current carloadings show encouraging strength . . . There are evidences of sporadic employment in coal, shoes, silk, canning, and of course a strong upswing of "sentiment" under the stimulus of strength in security and commodity markets . . . The end of October, with business 32% below normal, may prove to be the low point of the depression, but expectations of immediate or material pick-up before the end of the year may be discounted and the possibility of set-backs in speculative sentiment under discouraging news from abroad during the next two months must be kept in mind.

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Material Trends and Prices . . . .

Improvement noted this week in demand for automotive and railway steel. In other avenues of consumption, however, there is marked slowing down of buying interest. Livelier inquiry developing in pig iron. Lead and tin buying have displayed a few spurts in the last week but markets for zinc and copper remain featureless. Minor metals show no improvement.

(All prices as of Nov. 6, 1931)

IRON AND STEEL

Pig Iron —	Current	Mo. Ago	Yr. Ago
Birmingham, No. 2, Fdry., per gross ton	$11.00@$12.00	$12.00	$14.00
Buffalo, No. 2, Fdry., per gross ton	17.00	17.00	15.45
Heavy Melting Steel Scrap — Pittsburgh consuming point, No. 1, per gross ton	10.00	10.25	13.00
Furnace Coke — Connellsville, per net ton	2.40	2.40	2.60
Foundry Coke — Connellsville, per net ton	3.25	3.25	3.50
Steel Shapes — Pittsburgh, base, per 100 lb	1.60	1.60	1.60

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Iron Machinery Castings — Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight, 275 lb.:

Chicago	4.62½	Cleveland	4.50	New York	4.75
Cincinnati	4.35	Detroit	4.00		

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Steel Sheets — Prices in cents per lb., del. from warehouse stock (except at Pittsburgh) in lots of 401 to 999 lb., ordered and released for shipment at one time:

	Pitts. Mill	Chicago	Cleveland	New York
Blue annealed, No. 10	1.85	3.20	3.00	3.40
Black sheets, No. 24	2.40	3.55	3.60	3.50
Galvanized, No. 24	2.90	4.10	4.00	4.00

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Seamless Steel Tubing — Cold-drawn mechanical tubing, round, .10 to .30 carbon, in lots of less than 100 ft. or 100 lb., net, at N. Y. warehouse:

Thickness of Wall		Outside Dia. in Inches						
		½	⅝	¾	⅞	1	1¼	1½
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23

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Shapes, Plates, Bars, Etc. — Warehouse base prices in cents per lb., del. in lots of 401 to 999 lb., ordered and released for shipment at one time:

	New York	Cleveland	Chicago
Bands	3.40	3.00	2.95
Bars, soft steel	3.10	2.75	2.75
Cold fin., flat or square	3.90	3.60	3.60
Cold fin., round or hexagon	3.40	3.10	3.10
Cold rolled strips	4.95	6.00	5.50
Floor plates	4.85	5.00	5.00
Hoops	3.75	3.65	3.50
Rivets	4.00	4.00	4.00
Shapes	3.10	2.95	3.00
Spring steel	4.00	4.00	4.00
Tank plates	3.10	2.95	3.00

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Stainless Steel — Hot-rolled bars, base, Pittsburgh. 0.12 per cent carbon, cents per lb.:

Chromium		Chromium	
15% and under	19.00	18 to 23%	23.00
15 to 18%	20.50	23 to 30%	28.00

Bolts and Nuts — Discount from list, f.o.b. mills, Birmingham Chicago, Cleveland and Pittsburgh, on machine bolts, all sizes, cut thread; nuts, hot-pressed or cold punched; and lag screws, mill lots 73-10%

NON-FERROUS METALS

Prices following are in cents per lb. for mill shipments in carlots:	
Aluminum ingots 99%, N. Y	23.30
Copper, electrolytic, Conn	7.00
Copper wire, base, Chicago and Cleveland	9.37½
Copper wire, base, N. Y	9.25
Lead, pigs, E. St. Louis	3.65
Tin, Straits, pigs, spot, N. Y	22.25
Zinc, slabs, E. St. Louis	3.12½
Prices following are in cents per lb., base, N Y., Chi. and Cleve.:	
Brass rods, high	11.25
Brass sheets, high	13.00
Brass tubing, high	16.25
Copper, drawn round	13.62½
Copper sheets	16.12½
Copper tubing	15.62½
Prices following are in cents per lb., del. from N. Y. warehouse:	
Babbitt, anti-friction, general service	28.50
Babbitt, com'l, intermediate grade	34.25
Babbitt, genuine, highest grade	43.00
Solder, bar	17.87½
Prices following are in cents per lb., base, Huntington, W. Va.:	
Monel metal rods, hot rolled	35.00
Monel metal sheets, full finished	42.00
Monel metal tubing, seamless	65.00
Nickel rods, hot rolled	45.00
Nickel sheets, full finished	52.00
Nickel tubing, seamless	75.00

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Scrap Non-Ferrous Metals — Dealers' purchasing prices in cents per lb., f.o.b. cars:

	New York	Cleveland	Chicago
Heavy yellow brass	2.50	2.50	2.25
Light brass	2.00	1.75	2.00
No. 1 rod-brass turnings	3.00	2.75	2.50
Heavy copper	5.00	4.25	4.00
Light copper	4.00	3.75	3.50

SHOP SUPPLIES

(Prices at warehouse)	New York	Cleveland	Chicago
Abrasive disks, aluminum oxide No. 50 grain, cloth, 6-in. dia., X weight, per 100	$4.37	$4.59	$4.59
Belting, leather, heavy	30-10%	40%	40%
Belting, rubber, trans., Grade 1	60-10-10%	60-10%	60%

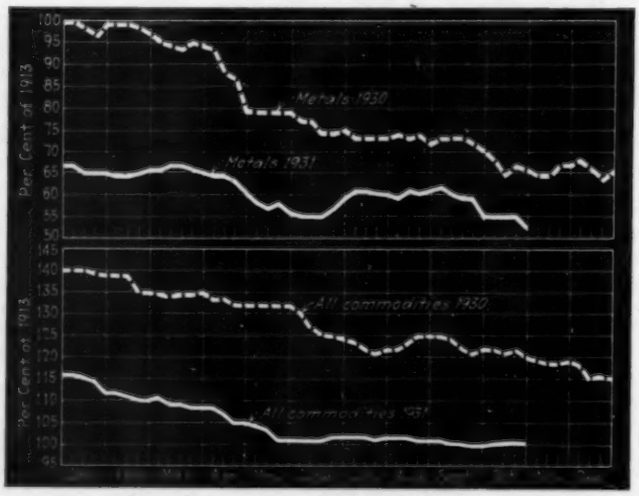
Lumber — Per M ft., b.m., 12-16 ft. lengths, delivered, N. Y.:

Crating — Southern pine:

1x4-in	$27.00	1x6-in	$26.00

Skids—Spruce:

2x4-in	$37.00	3x4-in	$40.00	4x6-in	$42.00	6x6-in	$50.00



Price Movements Week by Week

Average Price of Raw Metals: Pig Iron, Billet Steel, Copper, Tin, Lead, Zinc—American Machinist
Seventy-Four Commodities Index—The Annalist

NEWS

National Founders To Meet Next Week

The National Founders Association will hold its 35th annual convention at the Hotel Astor, New York City, Nov. 18 and 19. Reports of President S. Wells Utley, Commissioner A. E. McClintock and the Committee on Industrial Education will open the meeting. "The Modern Trend in Handling People" will also be explained at this session by A. D. Lynch, director of personnel, Ohio Brass Co. Following a special luncheon, Dr. Gerald Wendt will speak on "This Synthetic Age." The afternoon session will include: "The Crisis in Social Policy," by James A. Emery; "Signs and Portents," by Marc A. Rose, managing editor of *The Business Week;* "What's on the Worker's Mind in '31," by Whiting Williams; and "Russia, Menace or Opportunity," by John L. Lovett, general manager, Michigan Manufacturers' Ass'n. The Thursday morning session will include: "The Selective Application of Castings," by R. A. Bull, director, Electric Steel Founders' Research Group and "Modern Handling Methods in the Foundry," by H. L. Hoffman, engineer, Link-Belt Co. Following these papers, reports of the finance and resolutions committees will be presented, and officers will be elected.

Industrial Profits Drop Off

A tabulation of the statements of some 209 companies in the major manufacturing industries and in retail trade shows aggregate net profits after all charges, but before dividends, of approximately $97,000,000 in the third quarter, as compared with $167,000,000 in the preceding quarter and $131,000,000 in the first quarter. In the third quarter of 1930 the same companies had net profits of $192,000,000, from which the decline this year was 49.2 per cent. Included in the list are sixty companies reporting deficits for the third quarter this year as compared with 42 companies in the corresponding quarter of 1930. Forty-nine companies, however, improved their showing as compared with last year.

For the first nine months, net profits aggregated $392,000,000 in 1931 as against $741,000,000 in 1930, a decline of 47 per cent. There were fifty-two companies having deficits of $49,689,000 this year, and twenty-eight with deficits of $16,327,000 last year, which have been deducted in arriving at the totals. Net profits for machinery manufacturing concerns, according to the National City Bank of New York, were $5,451,000 for the first nine months of 1931, as compared with $15,591,000 for the corresponding period in 1930, a decline of 65 per cent. Net worth for the same period also dropped from $159,329,000 to $157,915,000, a decline of 0.9 per cent, and the annual rate of return in per cent dropped from 13.5 to 4.6. Automobile profits, outside General Motors, showed a net profit of $9,606,000 for the first nine months of 1931 as compared with $22,873,000 for the first nine months of 1930, a decline of 58 per cent. General Motors reports for a corresponding period $97,455,000 and $131,403,000, a drop of 25.8 per cent.

Gage Blanks Standard Reaffirmed

The existing standard CS8-30 on "Plain and Thread Plug and Ring Gage Blanks" has been reaffirmed without change for another year beginning July 1, 1931. According to reports from the accompanying survey, 72.9 per cent of the manufacturers adhere to the American Gage Design Standards.

The report of ASA Subcommittee No. 1 on Symbols for Mechanics, Structural Engineering and Testing Materials has been submitted to the ASA for adoption as an American Standard.

National Electrical Code Now Available

The National Electrical Code (C1-1931) approved as American standard by the A.S.A. in August, has now been published and is available. It was prepared under the sponsorship of the National Fire Protection Association and published by the National Board of Fire Underwriters.

Carl A. Johnson

Carl A. Johnson, president of the Gisholt Machine Co., Madison, Wis., died suddenly Oct. 30 at Madison. The news of his unexpected end was a severe shock to his many friends in the machine tool industry because it had been only a fortnight since he presided at the annual meeting of the National Machine Tool Builders' Association, at which he seemed to be in his accustomed health. At that meeting he concluded a second term as president of the organization.

Always interested in promoting cooperative activity on the part of individuals and groups, as evidenced by his success in coordinating the manufacturers of his own state, Mr. Johnson had been working for nearly a year on a program to arouse the metal-working industry to the need for further modernization of its equipment, hoping thereby to stimulate activity in the machinery building plants and thus to provide employment for many men in these plants, and in the plants engaged in the making of materials and parts needed by the machinery builders.

Mr. Johnson was born in Madison in 1870. He was graduated from the University of Wisconsin as a mechanical engineer with the class of 1891 and had always been an active alumnus. During his college course he spent his vacations working in the Gisholt plant which had been established by his father, John A. Johnson. He became president of it in 1908 and continued in that office until his death.

Among his many outside activities was the founding of the Madison Chamber of Commerce, of which he was the first president. He was for seven years president of the Wisconsin Manufacturers' Association, and was a director of the First National Bank of Chicago, of the Cutler-Hammer Manufacturing Co., and of the Chamber of Commerce of the United States.

Simplified Practice

Simplified Practice Recommendation R105-29 on Wheelbarrows has been revised and submitted to manufacturers, distributors, and users for acceptance.

Great Britain's Oversea Trading Benefited by Recent Changes

By Our London Correspondent

The crisis in the economic life of great Britain and the events which led to it have received so much attention in the press that nothing more than a passing reference can be excused here. Great Britain, of course, has taken full share in the general business decline. Now conditions are upset by the processes naturally associated with an election, the holding of which, it may be added, is excused on the ground of indirect external pressure, that is, the desire to impress opinion in other countries. With the suspension of the gold standard it was, of course, immediately suggested that the action implied both a bounty on exports and a duty on imports, that is, if other countries would be so obliging as to take no action. Certainly, in some areas there are signs of revival.

The issue of the latest Board of Trade statistical report on overseas trading enables a review to be made of British contact with the world in that direction for the first three quarters of the current year. In this period the value of imports totalled £631,-352,640, a decline of £163,675,245 as compared with the same period of 1930 and of £275,800,620 as compared with 1929. Thus the value of imports was roughly 80 per cent of the corresponding value in 1930. Exports of all kinds totalled £292,390,601, a decline of £148,-724,730 as compared with 1930 and of £251,020,505 as compared with 1929. Exports were thus nearly 70 per cent of 1930 figures and did not greatly exceed 50 per cent of the 1929 figures. In re-exports, that is exports of imported merchandise, the total was £48,-255,420, representing declines of £19,-423,089 and £36,182,510 as compared with 1930 and 1929. Adding exports and re-exports together and deducting them from imports leaves nearly £281,-000,000. It is a fairly common impression that this adverse balance has increased very rapidly during the current year. It has increased, but not to the extent thought, for the difference amounted to about £277,000,000 up to the same time last year, and about £270,000,-000 in the corresponding period of 1929. In each of these years it was estimated that the balance was met, and more than met, by so-called "invisible exports," i.e., by the earnings of shipping, profits on international banking, insurance profits, dividends and interest from overseas securities and loans, and so on. The income from overseas long-term investments has been estimated at £230,000,-000 per annum or more. If world trade and economic conditions generally had been maintained it is probable that even the present adverse balance could have been met. But they have not been maintained; the probable decline of this income for the whole of the current year has been variously estimated up to £100,000,000. Our recovery in export, shipping returns and overseas investments depends partly on ourselves but primarily on improvement in world conditions.

The general tendency in overseas trading in machinery can be gathered from Tables 1 to 3, which are con- of exported British machine tools. The present overwhelming importance of cerned respectively with imports, exports and re-exports. Table 4 sets out in broad terms the overseas destinations of exported British machine tools. The present overwhelming importance of the European market may be noted; the

TABLE I—IMPORTS OF MACHINERY

	Quantities — Nine Months Ended September 30			Value — Nine Months Ended September 30		
	1929 Tons	1930 Tons	1931 Tons	1929 £	1930 £	1931 £
Agricultural	6,000	7,466	7,446	407,914	488,174	490,341
Boilers and boiler house plant	1,963	1,358	1,042	188,259	150,110	111,535
Dairy machinery	744	842	773	144,650	151,409	142,185
Electrical machinery	5,236	4,472	3,312	1,347,831	1,358,829	1,075,227
Machine tools (metal-working)	7,853	8,182	7,529	1,415,057	1,308,186	1,060,822
Mining machinery:						
Coal cutters	202	96	72	67,453	35,727	23,697
Prime movers—not electrical	5,040	8,696	2,642	628,396	932,226	354,454
Paper-making machines	2,132	853	955	241,192	140,408	142,294
Printing, bookbinding, etc., machines	4,867	5,317	3,028	1,121,814	1,225,920	739,445
Pumps	3,257	2,664	1,496	438,642	423,855	221,677
Sewing machines, complete	556	380	405	133,996	117,061	109,567
parts	826	738	483	388,760	342,742	233,278
Textile machinery	6,285	4,053	3,759	1,206,559	816,969	711,991
Typewriters, complete	754	683	703	533,362	459,357	405,954
parts	97	80	76	89,832	75,493	68,825
Machines and machinery, all other sorts	39,335	36,826	32,370	5,899,697	5,782,823	4,726,345
	85,147	82,706	68,091	14,253,414	13,809,309	10,617,637

TABLE II—EXPORTS OF MACHINERY

	Quantities — Nine Months Ended with September 30			Value — Nine Months Ended with September 30		
	1929 Tons	1930 Tons	1931 Tons	1929 £	1930 £	1931 £
Agricultural machinery	18,046	18,716	10,089	1,422,172	1,397,831	773,931
Boilers and boiler-house plant	37,374	45,985	42,383	1,946,928	2,385,977	2,134,716
Cranes, hoists, etc.	24,926	26,900	17,151	1,664,525	1,808,722	1,141,964
Electrical machinery	28,921	30,585	20,078	4,694,347	4,745,009	3,241,012
Grain milling machinery	2,985	2,344	1,684	281,954	212,729	162,825
Machine tools (metal working)	12,170	10,619	9,000	1,632,618	1,412,344	1,291,748
Sugar-making and refining machinery (other than centrifugal)	7,714	4,699	2,588	474,178	276,233	161,742
Prime movers (not electrical)	38,010	28,657	18,250	3,912,400	3,116,402	2,224,521
Paper-making machines	3,436	1,046	679	322,743	150,359	110,411
Printing, bookbinding, etc., machines	3,868	3,807	2,415	868,893	879,188	563,912
Pumps	6,243	6,132	4,490	911,897	907,662	643,114
Sewing machines (complete)	633	562	471	143,241	123,462	87,816
Sewing machines (parts)	23,982	15,518	8,377	2,330,829	1,521,246	815,210
Textile machinery	97,786	72,410	38,779	8,904,290	6,892,869	3,867,402
Typewriters (complete)	32	41	19	64,157	70,451	35,715
Typewriters (parts)	71	31	37	62,006	46,309	41,403
Woodworking machinery not elsewhere specified	1,355	1,154	609	177,782	154,447	88,705
Machines and machinery all other sorts	108,869	97,793	66,925	10,253,587	9,846,440	6,921,478
Total of machinery	416,441	366,997	244,024	40,068,547	35,947,680	24,307,625

TABLE III—RE-EXPORTS OF MACHINERY

	Quantities — Nine Months Ended September 30			Value — Nine Months Ended September 30		
Machinery and parts thereof:	1929 Tons	1930 Tons	1931 Tons	1929 £	1930 £	1931 £
Agricultural	570	716	649	46,715	52,460	44,760
Dairy machinery	176	116	111	27,014	17,947	19,271
Electrical machinery	250	255	309	88,663	104,271	95,312
Machine tools (metal working)	269	208	228	49,549	40,266	41,913
Prime movers (not electrical)	84	132	484	23,183	30,843	50,655
Printing, bookbinding, etc., machines	194	148	98	69,678	47,656	47,845
Pumps	133	177	116	24,811	31,655	21,018
Sewing machines (complete)	22	24	17	20,159	18,183	12,429
Sewing machines (parts)	428	355	240	183,470	161,650	104,925
Textile machinery	213	209	119	128,728	88,873	64,701
Typewriters (complete)	50	44	38	49,562	38,288	32,395
Typewriters (parts)	3	5	1	3,554	4,770	3,030
Machines and machinery, all other sorts	1,940	2,821	1,691	494,862	583,739	392,713
Total of machinery	4,332	5,210	4,101	1,209,948	1,220,601	930,967

TABLE IV—EXPORTS OF MACHINE TOOLS

	Quantities — Nine Months Ended with September 30			Value — Nine Months Ended with September 30		
Machine tools (metal-working):	1929 Tons	1930 Tons	1931 Tons	1929 £	1930 £	931 £
To countries of Europe	4,390	4,539	5,404	668,065	667,582	842,583
To Union of South Africa	700	648	422	95,213	73,276	57,847
To British India	2,651	1,604	1,406	281,811	174,241	176,154
To Australia	787	448	95	92,674	53,203	12,913
To other countries	3,642	3,380	1,673	494,855	444,042	202,251
	12,170	10,619	9,000	1,632,618	1,412,344	1,291,748

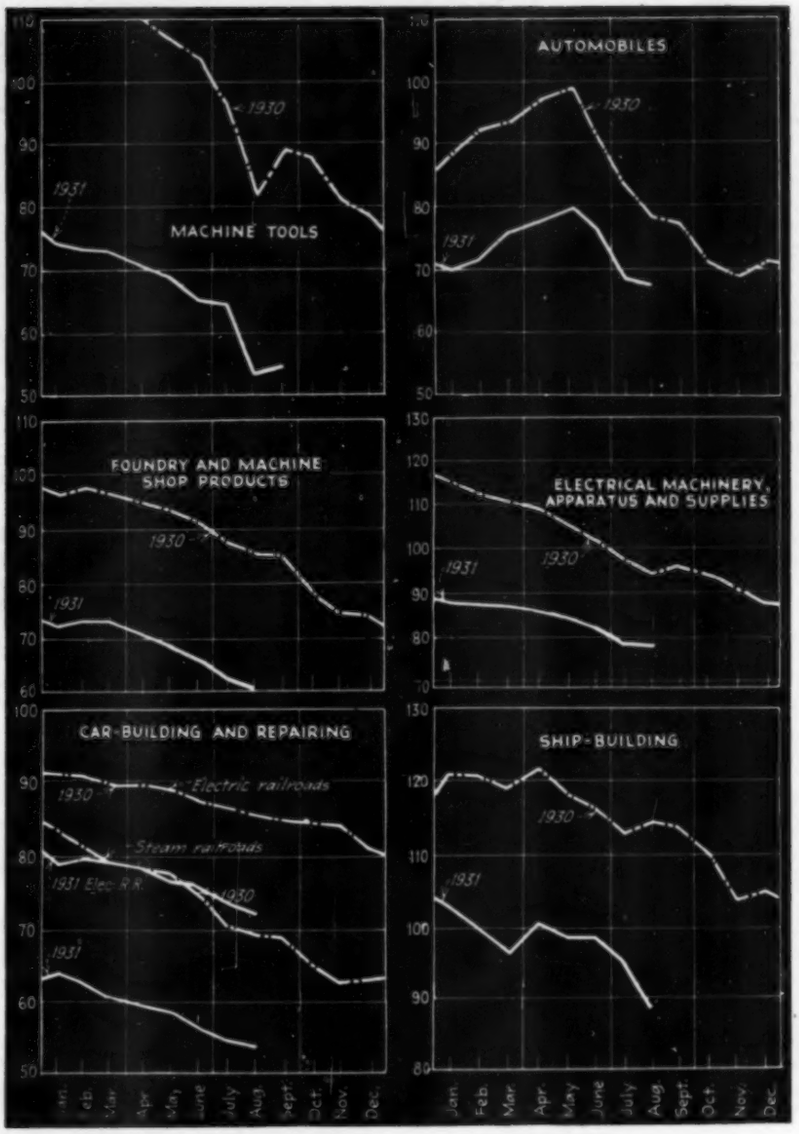
great decline in overseas areas regarded as British, particularly Australia, is the other feature. For the most part the countries of Europe mean Russia, followed at a considerable interval by France. Similarly, for the present it may be said that imported machine tools are mainly obtained from America and Germany in more or less equal proportions. Other countries hardly count, particularly if Switzerland be omitted.

Machine tool makers have for some time accepted considerable orders from the Soviet authorities and the result is to be seen in certain of the shops. So far the terms have been kept and payments have been made as due. Other engineering orders have come from the same source. Many, but not all, are insured under the government scheme, so that before the last parliament was dissolved it was stated that up to the beginning of September the Export Credits Department had guaranteed orders amounting to £3,644,000, the maximum length of credit being 30 months. Not all the orders have been on these terms or limited to this period of time. As the result of the suspension of the gold standard and the consequent effect on exchange values, it is thought that the premium charged may be lowered. The theory is that largely from payment for imports received by Great Britian the Russian authorities have been able to pay for machinery bought in the United States, whether for cash or on short-term bills. But, in view of the lowered exchange value of sterling on New York, larger amounts would be necessary; consequently it is thought that the sums will be used direct, to pay for goods ordered from Great Britain.

After many negotiations, six of the leading Lancashire manufacturers of textile machinery are to merge, and Textile Machinery Makers, Ltd., has been registered. The six firms concerned are Platt Bros. & Co., and Asa Lees & Co., Oldham; Dobson & Barlow, Bolton; Howard & Bullough, Accrington; and Brooks & Doxey, and Hetherington & Sons, Manchester. Their present combined capital in preference and ordinary shares amounts to £7,282,634. This is to be reduced to £3,403,000, divided not quite equally between preference and ordinary shares. Certain of the assets of the separate companies will be retained by them, but only a small proportion. The assets, estimated on a common basis and written down to a figure that should enable profits to be made, are to be handed over to the new company in exchange for shares in proportion to the holding, and a feature specially mentioned is that the company starts without debt.

Standards

The proposed standard for Rolled Threads for Screw Shells of Electric Sockets and Lamp Bases has been transmitted to the A.S.A. for approval and designation as an "American Standard" by the National Electrical Manufacturers' Association and the A.S.M.E., joint sponsors. The standard as originally approved by the A.S.M.E. in 1915 was based on practice established as early as 1888.



Trend of Employment in Metal-Working Industries Monthly average for 1926 = 100. Data supplied by the Bureau of Labor Statistics

Railway Income Shows Decline

Class I railroads of the United States for the first nine months of 1931 had a net railway operating income of $407,660,068, which was at the annual rate of return of 2.08 per cent on their property investment, according to reports just filed by the carriers with the Bureau of Railway Economics. In the first nine months of 1930, their net railway operating income was $660,901,036 or 3.44 per cent on their property investment.

Gross operating revenues for the first nine months totaled $3,279,306,284, as compared with $4,083,333,088 for the same period in 1930, a decrease of 19.7 per cent. Operating expenses for the first nine months of 1931 amounted to $2,524,542,897, as compared with $3,052,972,873 for the same period one year ago, or a decrease of 17.3 per cent.

Chicago Pneumatic Has 25-Year Group

The CP Quarter Century Association has been formed to include all present employees of the Chicago Pneumatic Tool Co., 6 E. 44th St., New York City, and its affiliates in its several manufacturing plants and offices who have completed 25 years or more of uninterrupted service. Seventy-five were eligible at the time of formation, and their total years of service numbered 2,112.

BUSINESS ITEMS

The Pittsburgh Equitable Meter Co., 400 North Lexington Ave., Pittsburgh, Pa., is expecting to buy a quantity of automatic chucking and screw machines for quantity production of small brass parts to be used in the production of water meters, according to W. F. Rockwell, president.

The Gray Iron Institute has moved its offices from the Terminal Tower Building, Cleveland, Ohio, to 4300 Euclid Ave., Cleveland.

The Torrington (Conn.) Co. has acquired H. Lydall & Foulds, Manchester, Conn., and will move machinery and equipment to Torrington about Jan. 1. The Manchester plant is at present working overtime.

The experimental machine, tool and die shop of the Presto Machine Products Co., 70 Washington St., Brooklyn, N. Y., will be sold at public auction Nov. 17, at 9:30 A.M., by the Industrial Plants Corp., 25 Church St., New York, N. Y.

The Buckeye Portable Tool Co., Dayton, Ohio, has moved from 135 Wayne Ave. to 29 West Apple St. to gain 50 per cent more room for expansion.

The Amesbury (Mass.) Brass & Foundry Co., manufacturer of display cases for frozen foods, has taken over the two three-story buildings which it has occupied in part.

The central offices of Noblitt-Sparks Industries, Inc., manufacturer of steel tubing for bicycles and other steel specialties, will be moved from Indianapolis to Columbus, Ind. Columbus was chosen because of its central location with respect to the company's factory branches at Columbus, Seymour and Greenwood, Ind.

The Perin Walsh Co., Boston, Mass., manufacturer of truck bodies and equipment, is moving to new quarters providing twice its former space and increasing employees from 100 to 150.

The Metal Products Corp., 510 First Ave., West Haven, Conn., will manufacture hardware and cooking utensils, employing about 60.

The Signal Electric Mfg. Co., Menominee, Mich., has appointed the following direct factory representatives: Naudi-Davies Co., Cleveland, Ohio; P. M. Day & Co., Detroit Mich.; Scott-Jacqua, Inc., Indianapolis, Ind., and W. C. Laing, Cincinnati, Ohio.

Complete contents of the plant of Brooks Steam Motors, Ltd., Stratford, Ont., are to be sold by the F. F. Barber Machinery Co., Ltd., Toronto.

The Reliable Automatic Sprinkler Co. of New England, 291 Ruggles St., Boston, Mass., has begun manufacture of sprinkler systems.

The Young Radiator Co., Racine, Wis., manufacturer of radiators for internal combustion engines, Diesel engines, pumps, compressors, etc., reports much increased activity during the past three months, and during September and October has been working night and day shifts in the sheet metal, stamping and assembly departments. Much of the activity has developed from a new line, according to officials.

The Standard Automatic Burner Co., Council Bluffs, Iowa, manufacturer of oil burning equipment, has completed its $20,000 plant and begun production with a scheduled output of 10 burners a day. E. R. Tomes and W. F. Tomes are joint owners of the plant. A foundry is in course of construction.

PERSONALS

Charles Beck, formerly president of the Beck Frost Ohio Co., Toledo, has been elected president of the Beck-Knob Corp., Chicago.

Irving H. Chase, president of the Waterbury (Conn.) Clock Co., has been elected chairman of the board of directors. C. W. Curtis of Orange, N. J., succeeds Mr. Chase as president.

Jerome M. Cook, formerly research engineer for the Hercules Motor Corp., Canton, Ohio, will become assistant superintendent of the experimental department, Oakland Motor Car Co., Pontiac, Mich.

Leighton Dunning, formerly manager of the shock-absorber division, Thompson Products, Inc., Detroit, has become purchasing agent for the Kellett Aircraft Corp., Philadelphia.

Henry J. Edling, formerly die-designing engineer and checker with the Fisher Body Corp., Detroit, has joined the Peninsular Engineering Co., Inc., also of Detroit, where he is president.

Claude O. Streeter, mechanical engineer in the power transmission field, has severed his connection in New York City and returned to his home in Shrewsbury, Mass. He has not announced any definite plans for the future.

Charles Fisher, with the Canadian Acme Screw & Gear Co., Ltd., Toronto, for 17 years, and since Jan. 1930 on the sales staff of the Canadian Rumley Co., Ltd., Toronto, Ont., has been appointed sales manager.

George F. Fuller, formerly president of the Wyman-Gordon Co., Worcester, Mass., has been made chairman of the board, and Harry G. Stoddard, formerly vice-president, has been elected president. F. A. Ingalls was re-elected vice-president. S. M. Havens, formerly works manager at the Ingalls-Sheppard division, Harvey, Ill., is now general manager there; J. D. Sutherland, formerly general sales agent at Harvey, is now assistant to the president; H. F. Wood, assistant works manager of the Ingalls-Sheppard division, has become works manager; J. H. Nelson was reappointed works manager of the Worcester, Mass., division, and F. E. Wellington, formerly manager of the aviation division in Worcester, was appointed district sales manager of the Worcester division.

Eric Geertz, formerly mechanical engineer with the Link Belt Co., Indianapolis, has been appointed chief engineer of the Barber Greene Co., Aurora, Ill.

Fred Glover, president of the Timken-Detroit Axle Co., parent organization, will also serve as president of the new combination of the Timken-Detroit Co., and the Silent Automatic Corp., which will be consolidated under the name Timken Silent Automatic Co., as of Jan. 1. All activities in the manufacture of oil-burning heating equipment will be conducted after this year at the Clark Avenue plant of the Timken-Detroit Axle Co.

Fred W. Hammer, formerly connected with the Philadelphia office, Warner & Swasey Co., has joined the sales organization of the Swind Machinery Co., Philadelphia, Pa., as sales engineer.

Fred C. Hebert, previously with the Seneca Falls Machine Co., Seneca Falls, N. Y., as sales engineer, has joined the Snyder Tool & Engineering Co., Detroit, in a similar capacity.

C. F. Herington, during the past nine years with Heyl & Patterson, Inc., Pittsburgh, has become a sales engineer with the Grindle Fuel Equipment Co., Harvey, Ill.

H. D. Hollinger, formerly division superintendent for the Ternstedt Mfg. Co., Detroit, has been appointed supervisor of the machine division, Servel, Inc., Evansville, Ind.

S. W. Rolph has been elected vice-president and general manager of the Willard Storage Battery Co., Cleveland. Mr. Rolph joined the Willard organization in 1916, becoming southern California district manager and later assistant manager of the Pacific Coast district. In 1918 he came to Cleveland as a member of the renewal sales department.

Frank H. Willard, president, Graton & Knight Co., Worcester, Mass., was elected president at the annual meeting of Associated Industries of Massachusetts. Frank P. Cox, works manager, West Lynn plant, General Electric Co., and John F. Tinsley, general manager, Crompton & Knowles Loom Works, Worcester, were elected vice-presidents. Members of the executive committee include the above and George S. Barton, Rice, Barton & Fales, Inc., Worcester; Rice S. Clark, Package Machinery Co., Springfield; James D. Hunter, president, James Hunter Machine Co., North Adams; Robert M. Leach, treasurer, Glenwood Range Co., Taunton; Frank Mossberg, president, Mossberg Pressed Steel Corp., Attleboro; Sydney R. Mason, Whitin Machine Works, Whitinsville; Arthur B. Reynders, works manager, Westinghouse Electric & Mfg. Co., East Springfield; John W. Shepherdson, director, Morgan Construction Co., Worcester; Clifford S. Anderson, general counsel, Norton Co., Worcester, the latter also being a past president of the Associated Industries.

A. W. THOMPSON, vice-president of Fairbanks, Morse & Co., Beloit, Wis., is now in charge of all manufacturing operations of the company's four plants to replace W. C. HEATH, whose resignation was announced last week. Mr. Thompson is an engineer by education, having been graduated from the Rennselaer Polytechnic Institute in 1907. Upon his graduation he became associated with the George A. Just Co., New York City, and later with Westinghouse, Church, Kerr & Co. In 1910 he joined the General Electric Co. and remained there for ten years, during which time he was in charge of the design and development of the Erie Works. In 1920 Mr. Thompson joined the Fairbanks-Morse oragnization as general manager of the Indianapolis plant, and in 1926 he was transferred to San Francisco as Pacific Coast manager in charge of sales. In 1928 he was made a vice-president. He has, during this period, maintained close contact with all the manufacturing properties of the company, particularly that at Beloit, Wis., where he will make his headquarters.

HERBERT W. HOUSTON, formerly superintendent of the Hughes Development Co., Los Angeles, Calif., has become superintendent and part owner of the Pomeroy Co., Los Angeles, manufacturer of motion-picture equipment.

J. OTIS PIERCE, formerly vice-president and sales manager of the Brown-Lipe Gear Co., Syracuse, N. Y., now a subsidiary of the Spicer Mfg. Co., Toledo, Ohio, has resigned.

W. L. MELLON has been elected a member of the executive committee, Westinghouse Electric & Mfg. Co., to succeed the late HARRISON NESBIT.

A. A. PROBECK has been appointed sales manager of the Federal Machine & Welder Co., Dana Ave., Warren, Ohio. Mr. Probeck began welding work in 1910 with the C. & C. Co. He joined Federal in 1912 and in 1917 returned to the arc-welding field.

SAMUEL E. RUSINOFF, formerly mechanical designer of the National Lock Washer Co., Newark, N. J., has become purchasing engineer in the machine-tool-building division of the Amtorg Trading Corp., New York City, commercial representative of the Soviets in this country.

J. N. REMSEN, formerly with the Central Alloy Steel Corp., Canton, Ohio, has become assistant sales manager for the Eastern Rolling Mill Co., Baltimore.

JAMES N. SCULLY, treasurer of the Houdaille Co. from 1920 to 1926, is a director of the Thermo-Hydraulic Shock Absorber Co., Cambridge, Mass.

B. S. SHENSTONE, formerly with the Junkers Flugzergwerk, A.G., at Dessau, Germany, has joined the Supermarine Aviation Works, Ltd., Southampton, England.

LEWIS F. SHOEMAKER has been appointed president and treasurer of the Shoemaker Bridge Co., to succeed his father, LEWIS F. SHOEMAKER, SR., who died Oct. 15.

OBITUARIES

ROBERT H. RIPLEY, 55, senior vice-president of the American Steel Foundries, Chicago, and chairman of the board, General Steel Castings Corp., Eddystone, Pa., died Nov. 5 at Chicago. He had been connected with the steel castings industry for 30 years, since 1906 as an A.S.F. vice-president.

RICHARD TELLER CRANE, Jr., 58, president of the Crane Co., Chicago, died of heart disease in New York Nov. 7. Mr. Crane became head of the company when his father, the founder, died in 1914. He had been connected with it since 1897, and during the last six years had distributed $12,000,000 of his private fortune in stock to employees.

EDWARD D. BOECK, 75, formerly foundry superintendent of the American Radiator Co., Buffalo, died recently. He had been with the company for 44 years prior to his retirement several years ago.

FRANK L. CARTER, 63, designer and motor car manufacturer and formerly treasurer of the Carter Motor Car Co., Hyattsville, Md., which manufactured automobiles from 1907 to 1911, died in Miami, Fla., Nov. 2 after an illness of several months. He retired in 1912.

GEORGE F. P. DAY, 82, prominent railroad engineer in Massachusetts about 25 years ago, died at San Diego, Calif., Nov. 3. At the age of 15 he entered the employ of the Fitchburg Railway Co., and later became assistant chief engineer. He retired 20 years ago.

ERNEST DUBERT, employed continuously 37 years as die maker foreman for the Huntley Mfg. Co., Silver Creek, N. Y., and later Brocton, N. Y., died in Buffalo, Oct. 21.

GUSTAV ERBE, 79, president of the Yawman & Erbe Mfg. Co., Rochester, N. Y., and of the Office Specialty Mfg. Co., Toronto, Ont., died at Rochester Oct. 30, following a heart attack.

GEORGE H. FUNK, 76, a founder of the Funk Bros. Mfg. Co., now the Funk Forging Co., Chicago Heights, Ill., died Oct. 29, from injuries received in an automobile accident. He sold his interest in the company three years ago.

EDWARD E. GOLD, 84, inventor of the car-heating system now in use on most railroads in the United States, Canada and Europe, died Oct. 30 of a heart attack. He had been ill but 24 hours, and had visited the offices of the Gold Car Heating & Lighting Co., 220 Thirty-sixth St., Brooklyn, N. Y., of which he was chairman of the board.

JOHN W. W. HICKLIN, 62, president of the Portable Oven Co., Chicago, Ill., and the Hubbard Oven & Mfg. Co., Boonton, N. J., died suddenly Oct. 31 in New York City.

LOUIS JOHNSON, 59, for 25 years owner of the former Acme Journal Bearing Co., Van Buren & Canal Sts., Chicago, died recently there. He was sole owner of the Acme company for 25 years previous to the sale of his interest seven years ago.

GEORGE W. MCNAMEE, 46, former purchasing agent for the Holt Co., Peoria, Ill., prior to its acquisition by the Caterpillar Tractor Co., and before that time district representative for Foote Bros., died suddenly Oct. 25.

LEWIS TAYLOR ROBINSON, 63, engineer in charge of the general engineering laboratory, General Electric Co., Schenectady, N. Y., died suddenly there Nov. 3 of a heart attack. One of the best known of electrical engineers, he had been head of one of the principal laboratories of the General Electric for the last twelve years. He had been connected with the company since 1885, and the laboratory under his direction brought out many electrical devices including the oscillograph, the mercury arc rectifier and the photophone, which produces sound pictures. He had received some thirty patents.

BENJAMIN R. THURSTON, 52, general superintendent of the American Screw Co., Providence, R. I., died there Nov. 3.

MEETINGS

NATIONAL FOUNDERS ASSOCIATION
Thirty-fifth Annual Convention, Hotel Astor, New York City, Nov. 18-19. J. M. Taylor, secretary, 29 South La Salle St., Chicago, Ill. Eastern Office, 5633 Grand Central Terminal Bldg., New York, N. Y.

INTERNATIONAL ACETYLENE ASSOCIATION
Thirty-second Annual Convention, Congress Hotel, Chicago, Nov. 11-13. Headquarters, 30 East 42nd St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Annual meeting, Engineering Societies Bldg., New York, N. Y., Nov. 30-Dec. 5. Calvin W. Rice, secretary, 29 West 39th St., New York, N. Y.

TAYLOR SOCIETY
Annual Meeting, Hotel Pennsylvania, New York City, Dec. 2-4, Dr. H. S. Person, managing director, 29 West 39th St., New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS
Annual meeting, Book-Cadillac Hotel, Detroit, Mich., Jan. 25-29. John A. C. Warner, secretary, 29 West 39th St., New York, N. Y.

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Opportunities for Future Business

Ala., Tuskegee—Tuskegee Normal & Industrial School, R. R. Moron, Pres., 16 Cooper Sq., New York, N. Y., awarded contract for the construction of Thomas A. Edison science and engineering building here. Noted June 4.

Calif., Berkeley—B. F. Sturtevant Co., 2530 Sixth St., plans first unit of plant for the manufacture of ventilating apparatus, etc. at Gilman, Gamelia, Ninth and Eighth Sts. Estimated cost $500,000.

Colo., Hillside—Cloverdale Mines Co., c/o W. B. Porch, Pres., Canon City, plans to rebuild gold ore mill here, 75 ton capacity. Estimated cost from $35,000 to $50,000. Maturity in spring.

Conn., East Haven—Viking Flying Boat Co., c/o M. Linenthal, 250 Devonshire St., Boston, will soon award contract for the construction of a 1 and 2 story, 85 x 100 ft. airplane hangar, 25 x 100 ft. shop and office building, etc.

Conn., Middletown—L. Combe, 12 Main St., is receiving bids for the construction of an automobile service garage at Main and Williams Sts. Estimated cost $40,000. C. E. Segerberg, Barbard Road, Archt.

D. C., Washington—U. S. Engineers Office, War Dept., awarded contract for the construction of a steel storage building and shop building at 11th and O. Sts. S. E. $17,940.

Ill., Aurora—Chicago, Burlington & Quincy R.R., 547 Jackson Blvd., Chicago, awarded contract for a 212 x 311 ft. coach shop here to replace structure destroyed by fire. Noted September 24.

Ind., Elkhart — Illinois Carton Co., 2601 North Crawford Ave., Chicago, Ill., completed plans for construction of a 1 story, 130 x 200 ft. factory at Clark and Elkhart Sts. here. Estimated cost $40,000. Private plans.

Ind., Hammond—Lever Bros. Co., 164 Broadway, Boston, Mass., soap manufacturers, is having plans prepared for a 4 story addition to factory here. Estimated cost $1,000,000. Stone & Webster, Inc., 49 Federal St., Boston, Mass., Archts. and Engrs.

Ind., Indianapolis—Highland Investment Co., Union Stock Yards, awarded contract for the construction of a service station at 38th St. and Central Ave. Estimated cost $40,000.

Mass., Brockton—Packard Car Agency, Warren Ave., awarded contract for a 1 story, 100 x 200 ft. garage. Estimated cost $50,000. Noted October 22.

Mass., Somerville (Boston P. O.)—William H. Greene, 73 Hinckley St., plans a 1 story garage on Broadway. Estimated cost $55,000. Private plans.

Mass., Springfield—Gibralta Garage & Office Co., W. A. Dunne, Highland Hotel, completed plans for an 8 story, 200 x 205 ft. garage and office building at Vernon St. and Columbus Ave. Estimated cost $1,000,000. L. S. Joslin, 339 Newbury St., Boston, Archt.

Mass., Westboro—Bay State Abrasive Products Co., O. S. Bucknam, Supt., will build a 2 story, 40 x 100 ft. addition to factory. Estimated cost $50,000. Private plans. Work will be done by owners' forces.

Mich., Detroit — Timken Detroit Axle Co., Clark Ave., plans alterations to plant for the manufacture of Timken silent automatic oil burners. Estimated cost to exceed $40,000. Work will probably be done by day labor.

Minn., Cloquet—Berst-Forster-Dixfield Co., is receiving bids for a 3 story, 106 x 274 ft. factory. Homan H. Hallock, Oswego, N. Y., Archt. and Engr.

Minn., Virginia—Board of Education, H. O. Olson, Clk., awarded contract for a 3 story, 59 x 75 ft. garage and band hall. Estimated cost $60,000. J. Albert Codding, First National Bank Bldg., Archt.

Mo., St. Louis—Kranz Automotive Body Co., 3032 Gravois Ave., awarded contract for a 1 story, 54 x 125 ft. automobile body plant at 3127-29 Minnesota St.

Neb., Curtis—State Board of Regents, University of Nebraska, L. F. Seaton, Operating Supt., is receiving bids for a 1 story, 65 x 100 ft. shop building at State School of Agriculture. Estimated cost $30,000. Meginnis & Schaumberg, 614 Federal Trust Bldg., Lincoln, Archts. Noted October 1.

N. J., Bordentown—State Department of Institutions & Agencies, Trenton, will receive bids until December 1, for 2 story, 65 x 160 ft. boys' dormitory building at Manual Training & Industrial School for Colored Youth here. Estimated cost $200,000. Guilbert & Betelle, Chamber of Commerce Bldg., Newark, Archts.

N. Y., Brooklyn—Department of Hospitals, Municipal Bldg., New York, is having sketches made for a miscellaneous service and repair shop for Kings County Hospital in vicinity of Clarkson Ave. and Albany St. Estimated cost $65,000. L. P. Ward, 205 East 42nd St., New York, Archt.

N. Y., Brooklyn—Two Hundred West Twenty Sixth Street Inc., S. Silk, Pres., 50 Clark St., plans the construction of a 4 story garage building at Brighton Beach Ave. and Parkway Court. Estimated cost $250,000.

N. Y., College Point—Corp., c/o John R. Thompson Agency, 8-23 Astoria Ave., Astoria, plans reconditioning ship yard including construction of additional facilites here. Estmated cost to exceed $40,000. Maturity indefinite.

N. Y., Long Island City—E. Eisnacker, 204 West 14th St., New York, plans a 2 story, 50 x 100 ft. factory at 45th Ave. and 11th St. Estimated cost $40,000. H. Feldman, c/o owner, Archt.

N. Y., Maspeth—Maspeth Realty Associates, 162 Remsen St., Brooklyn, is having sketches made for a 2 story, 100 x 200 ft. service garage at Maspeth and 53rd Aves. here. Estimated cost $100,000.

N. Y., New York — Cullen Fuel Co., 192 Lexington Ave., plans the construction of a 2 story, 30 x 100 ft. scale box, office and coal yard at Ferris Pl. and Kirk St. Estimated cost $40,000. Nicholson Co., 405 Lexington Ave., Archt.

N. Y., New York—Superior Fireproof Door & Sash Co., 1811 Carter Ave., is having sketches made for a 2 story, 50 x 100 ft. factory at Barnard and Barbour Sts. Estimated cost $40,000. H. Ginsberg, 205 East 42nd St., Archt.

N. Y., New York—U. S. Trucking Corp., 17 Battery Pl., is having sketches made for the construction of a service garage at 41 East St. and Rivington Ave. Estimated cost $40,000. Philip Bardes, 230 Grand St., Archt.

N. Y., Ozone Park — Liberty Woodhaven Realty Co., 103-58 Woodhaven Blvd., plans a 115 x 180 ft. service garage at Rockaway Blvd. and 93rd St. Estimated cost $40,000. P. Freshman, 50 Court St., Brooklyn, Archt.

N. Y., Ozone Park—P. & W. Auto Co. Inc., 86th St. and Liberty Ave., is having sketches made for a 100 x 100 ft. garage and repair shop at 86th St. and 103rd Ave. Estimated cost $40,000. C. Goodman, 375 Fulton St., Brooklyn, Archt.

N. Y., Poughkeepsie—Dept. of Architecture, State Office Bldg., Albany, received lowest bid for the construction of a work shop and storage building for Department of Public Works here from Fellow-Brown Construction Corp., 152 West 42nd St., New York. Noted October 29.

N. Y., Winfield—Vincent Scudderi, 4009 82nd St., Jackson Heights, will build a 2 story, 94 x 100 ft. factory and warehouse here. C. Stodolph, Elmhurst, Archt. Work will be done by day labor and separate contracts. Sutro Products Co., 4009 82nd St., Jackson Heights, lessee.

O., West Lafayette—Moore Enameling Mfg. Co., plans the construction of a 1 story plant adjoining present plant, will be used for the manufacture of enameled kitchen utensils and will double capacity. Estimated cost $50,000. Private plans.

Tex., College Station—A. & M. College will receive bids about January 1, for the construction of a 3 story, 80 x 120 ft. agricultural engineering building and 3 story, 60 x 110 ft. petroleum engineering and geology building. Cost $200,000 each. Work will be done by day labor.

Wis., Kaukauna—Thilmary Pulp & Paper Co., M. S. Wertheimer, Pres., awarded contract for a 2 story, 60 x 95 ft. plant and turbine room. Estimated cost $40,000. Noted October 8.

Ont., Hamilton—Canadian Westinghouse Electric Co., N. S. Braden, Mgr., is having plans prepared for addition to plant and installation of equipment. Estimated cost $250,000.

Ont., Port Carling—Port Carling Boat Works, Alex Shields, plans reconstruction of boat building factory completely destroyed by fire. Loss $35,000. Interested in equipment.

Ont., Preston—James Gillies plans to rebuild planing mill destroyed by fire. Loss $50,000. Interested in prices on equipment.

Ont., Ridgetown — Superior Chain Plating Co., John Slasarchuk, Gen. Mgr., Richard St., will soon start work on a new 1 story, 50 x 100 ft. factory. Interested in prices on complete equipment.

Que., Montreal — Costello Shank Company, Ltd., plans the construction of plant for the manufacture of shoe findings. Estimated cost $30,000.

Japan, Tokyo—Mitsubishi Company of Tokyo, is having plans prepared for erection of a plant for the manufacture of patent fuel, 400,000 ton annual capacity. Estimated cost $300,000.

T. H., Wheeler Field—Constructing Quartermaster, awarded contract for four air corps double hangars, machine shop, assembly shop, and warehouse. $279,000.

Equipment Wanted

Mass., Annisquam (sta. Gloucester)—James E. Ellery—small saw mill.

Mass., Jamaica Plain (sta. Boston) — H. Bettoney, 106 Chestnut St.—complete equipment for brass foundry.

Mass., Lynn—Keystone Sole & Shank Co., 601 Washington St.—hand milling machine, equipped with two spindles.

Mass., Malden (Boston P. O.) — M. McDonough Co., Broadway—screw cutting lathe, 36 in. swing for 16 ft. bed.

Mass., Medford (br. Boston)—Boshco & Bellows, 61 Riverside Ave.—woodworking lathes.

Mich., Detroit — Allied Die Cast Co. of America, 7420 Melville Ave.—miscellaneous machine equipment for die casting shop including oil gear pump.

Mich., Detroit — J. Lewis, 1173 Dickerson Ave.—10 ft. 10 gage steel bending brake and arc welding machine.

Minn., Cloquet—Berst-Forster-Dixfield Co.—complete machinery and equipment for the manufacture of wood specialties, for proposed 5 story, 106 x 274 ft. factory.

N. B., Oakville—Charles S. Briggs—machinery and equipment for proposed sawmill.

Ont., Timmins—Rudolph & McChesney—machinery and equipment for proposed sawmill Estimated cost $50,000.

Que., Montreal — Costello Shank Company, Ltd.—machinery and equipment for the manufacture of shoe findings for proposed plant.